

# NATIONAL BUREAU OF STANDARDS REPORT

8611

on  
Interlaboratory Intercomparisons  
of  
40-Watt Fluorescent Lamps

by  
Velma I. Burns  
Photometry and Colorimetry Section  
Metrology Division



U.S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS

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NBS PROJECT

2120113

December 1964

NBS REPORT

8611

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NATIONAL BUREAU OF STANDARDS



Interlaboratory Intercomparisons  
of  
40-Watt Fluorescent Lamps

ABSTRACT

Three groups of 40-Watt fluorescent lamps, F40T12/Cool White, F40T12/Day-light and F40T12/Pink, were measured in each of six laboratories. Each group was measured while holding the line voltage constant at 236.0 volts and again measured while holding the lamp Watts constant at 40 Watts. Luminous flux, lamp current, lamp voltage, and lamp watts were measured. The results of the measurements made by the individual laboratories and an analysis of the results are given in this report.

1. INTRODUCTION

This intercomparison was undertaken to determine the uniformity of measurements of three colors of fluorescent lamps made at the participating laboratories. The laboratories participating and the order of reading are as follows:

1. Westinghouse
2. Champion
3. Sylvania
4. El Tronics
5. General Electric
6. Duro Test

Each laboratory followed its own customary procedure in making the measurements. In each laboratory the lamps were measured while using a standard reactor of 439 ohms impedance, 7-8% power factor. The measurements were made while holding the line voltage constant at 236.0 volts and measurements were made again while holding the lamp watts constant at 40 watts. Luminous flux, lamp current, lamp voltage and lamp watts were measured and lumens per watt were computed.

II. RESULTS OF MEASUREMENTS

The results are reported in tables 1 through 15. The averages reported for each lamp and for each laboratory are also given. The difference,  $\Delta$ , between the average for each laboratory and the average for all the laboratories for all the lamps is also given in the tables.



### III. ANALYSIS OF RESULTS

An analysis of the results of the measurements has been made following a modification of the method described by W. J. Youden (1), (2) and (3). The modification is described in National Bureau of Standards Report No. 6605, Interlaboratory Intercomparisons of 32-Watt T12 Cool White Circline Lamps, and Report No. 6698, Interlaboratory Intercomparisons of 40 Watt T12 Cool White Fluorescent Lamps. The analysis is shown on the following graphs. The point representing the measurements of an individual laboratory is designated by the first letter in the name of that laboratory. The point representing the average of all the laboratories is designated by the letter A.

- (1) A Graphical Diagnosis of Interlaboratory Test Results, Industrial Quality Control, Vol. XV, No. 11, May 1959.
- (2) Product Specification and Test Procedures, Industrial and Engineering Chemistry, Vol. 50, page 914, October 1958.
- (3) Circumstances Alter Cases, Industrial and Engineering Chemistry, Vol. 50, page 77A, December 1958.





Table 1

F40T12/Cool White Lamps  
Operated at 236.0 line volts

Lumens

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
1	2616	2596	2596	2618	2631	2602	2610
2	2625	2606	2596	2615	2661	2618	2620
3	2589	2570	2572	2595	2620	2578	2587
4	2599	2582	2596	2594	2624	2583	2596
5	2631	2608	2622	2616	2639	2619	2622
6	<u>2558</u>	<u>2536</u>	<u>2550</u>	<u>2530</u>	<u>2575</u>	<u>2541</u>	<u>2548</u>
Ave	2603	2583	2589	2595	2625	2590	2597
$\Delta$	+ 6	- 14	- 8	- 2	+ 28	- 7	
% $\Delta$	.23	.54	.31	.08	1.08	.27	

Operated at 40 Watts

1	2574	2564	2600	2570	2544	2570
2	2606	2584	2549	2603	2540	2576
3	2552	2542	2510	2555	2502	2532
4	2582	2550	2520	2562	2517	2546
5	2584	2600	2536	2573	2577	2574
6	<u>2534</u>	<u>2530</u>	<u>2460</u>	<u>2508</u>	<u>2471</u>	<u>2501</u>
Ave	2572	2561	2529	2562	2525	2550
$\Delta$	+ 22	+ 11	- 21	+ 12	- 25	
% $\Delta$	.86	.43	.82	.47	.98	



Table 2

F40T/Cool White Lamps  
Operated at 236.0 volts

Amperes

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
1	0.431	0.428	0.430	0.421	0.430	0.425	.4275
2	.431	.429	.431	.425	.429	.425	.4283
3	.430	.426	.430	.426	.429	.425	.4277
4	.432	.430	.429	.426	.430	.425	.4287
5	.430	.428	.430	.426	.429	.425	.4280
6	.430	.428	.431	.425	.430	.425	.4282
Ave	<u>.4307</u>	<u>.4282</u>	<u>.4302</u>	<u>.4248</u>	<u>.4295</u>	<u>.4250</u>	<u>.4281</u>
$\Delta$	+ .0026	+ .0001	+ .0021	- .0033	+ .0014	- .0031	
% $\Delta$	.61	.02	.49	.77	.33	.72	

Operated at 40 Watts

1		0.423	0.423	0.416	0.416	0.414	0.4184
2		.429	.427	.411	.417	.412	.4192
3		.423	.423	.414	.414	.409	.4166
4		.430	.420	.412	.416	.411	.4178
5		.424	.429	.412	.415	.414	.4188
6		<u>.427</u>	<u>.427</u>	<u>.410</u>	<u>.415</u>	<u>.411</u>	<u>.4180</u>
Ave		<u>.4260</u>	<u>.4248</u>	<u>.4125</u>	<u>.4155</u>	<u>.4118</u>	<u>.4181</u>
$\Delta$		+ .0079	+ .0067	- .0056	- .0026	- .0063	
% $\Delta$		1.89	1.60	1.34	.62	1.51	



Table 3

F40T12/Cool White Lamps  
Operated at 236.0 line volts

## Lamp Volts

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
1	103.9	104.1	102.7	106.0	104.2	106.7	104.6
2	103.7	103.2	102.3	106.7	104.5	106.1	104.4
3	104.7	105.0	103.0	106.7	104.6	106.1	105.0
4	103.1	103.1	103.5	106.0	103.9	106.5	104.4
5	103.6	103.9	102.5	106.5	104.5	106.5	104.6
6	<u>103.8</u>	<u>103.9</u>	<u>102.0</u>	<u>106.9</u>	<u>104.1</u>	<u>106.6</u>	<u>104.6</u>
Ave	103.8	103.9	102.7	106.5	104.3	106.4	104.6
△	- .8	- .7	-1.9	+ 1.9	- .3	+ 1.8	
%△	.76	.67	1.82	1.82	.29	1.72	

## Operated at 40 Watts

1		104.2	103.0	106.0	105.1	106.9	105.0
2		103.2	102.5	107.1	105.1	107.0	105.0
3		104.9	103.0	107.8	106.0	108.0	105.9
4		103.1	103.5	106.7	105.1	107.5	105.2
5		104.2	102.0	107.1	105.5	107.6	105.3
6		<u>103.9</u>	<u>102.5</u>	<u>107.1</u>	<u>105.3</u>	<u>107.2</u>	<u>105.2</u>
Ave		103.9	102.7	107.0	105.4	107.4	105.3
△		- 1.4	- 2.6	+ 1.7	+ .1	+ 2.1	
%△		1.33	2.47	1.61	.09	1.99	

Table 4

F40T12/Cool White Lamps  
Operated at 236.0 line volts

## Watts

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
1	40.6	40.4	40.5	40.1	41.0	41.1	40.6
2	40.3	40.0	40.2	41.2	40.9	41.1	40.6
3	40.8	40.3	40.5	41.5	41.1	41.0	40.9
4	40.3	40.0	40.7	41.2	40.9	41.0	40.7
5	40.2	40.1	40.2	41.5	41.0	41.0	40.7
6	<u>40.5</u>	<u>40.1</u>	<u>40.3</u>	<u>41.2</u>	<u>41.0</u>	<u>41.0</u>	<u>40.7</u>
Ave	40.5	40.2	40.4	41.1	41.0	41.0	40.7
△	- .2	- .5	- .3	+ .4	+ .3	+ .3	
%△	.49	1.23	.74	.98	.74	.74	



Table 5

F40T12/Cool White Lamps  
 Operated at 236.0 line volts

Lumens per Watt

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syle</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
1	64.4	64.2	64.1	65.3	64.2	63.3	64.2
2	65.1	65.2	64.6	63.5	65.1	63.7	64.5
3	63.5	63.8	63.5	62.5	63.7	62.9	63.3
4	64.5	64.6	63.8	63.0	64.2	63.0	63.8
5	65.4	65.0	65.2	63.0	64.4	63.9	64.5
6	63.2	63.2	63.3	61.4	62.8	62.0	62.6
Ave	64.4	64.3	64.1	63.1	64.1	63.1	63.8
$\Delta$	+ .6	+ .5	+ .3	- .7	+ .3	- .7	
% $\Delta$	.94	.78	.47	1.10	.47	1.10	

Operated at 40 Watts

1	64.4	64.1	65.0	64.2	63.6	64.3
2	65.2	64.6	63.7	65.1	63.5	64.4
3	63.8	63.6	62.8	63.9	62.6	63.3
4	64.6	63.8	63.0	64.0	62.9	63.7
5	64.6	65.0	63.4	64.3	64.4	64.3
6	63.4	63.2	61.5	62.7	61.8	62.5
Ave	64.3	64.0	63.2	64.0	63.1	63.7
$\Delta$	+ .6	+ .3	- .5	+ .3	- .6	
% $\Delta$	.94	.47	.78	.47	.94	





Table 6

F40T12/Daylight Lamps  
Operated at 236.0 line volts

Lumens

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	2256	2266	2276	2214	2313	2270	2266
3	2232	2264	2298	2214	2298	2257	2260
4	2254	2278	2304	2240	2323	2274	2279
6	2236	2260	2256	2175	2297	2236	2243
7	2231	2256	2290	2190	2289	2260	2253
8	2232	2264	2298	2200	2273	2250	2253
10	2233	2264	2264	2186	2292	2266	2251
12	2244	2260	2306	2232	2302	2266	2268
Ave	2240	2264	2286	2206	2298	2260	2259
$\Delta$	- 19	+ 5	+ 27	- 53	+ 39	+ 1	
% $\Delta$	.84	.22	1.20	2.35	1.73	.04	

Operated at 40 Watts

2	2290	2260	2189	2290	2223	2250
3	2244	2270	2136	2229	2181	2212
4	2278	2314	2165	2285	2242	2257
6	2274	2244	2160	2261	2171	2222
7	2262	2302	2190	2250	2220	2245
8	2270	2294	2194	2222	2211	2238
10	2298	2218	2075	2290	2246	2225
12	2270	2286	2216	2267	2216	2251
Ave	2273	2273	2166	2262	2214	2238
$\Delta$	+ 35	+ 35	- 72	+ 24	- 24	
% $\Delta$	1.56	1.56	3.22	1.07	1.07	



Table 7

F40T12/Daylight Lamps  
Operated at 236.0 line volts

Amperes

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	0.433	0.429	0.432	0.426	0.431	0.427	0.4296
3	.427	.426	.429	.422	.428	.424	.4260
4	.432	.431	.432	.426	.433	.429	.4305
6	.432	.430	.432	.421	.430	.427	.4287
7	.429	.428	.432	.422	.431	.427	.4282
8	.431	.428	.434	.424	.430	.425	.4287
10	.433	.430	.431	.424	.432	.427	.4295
12	.431	.428	.431	.421	.430	.425	.4277
Ave	.4310	.4288	.4316	.4232	.4306	.4264	.4286
$\Delta$	+ .0024	+ .0002	+ .0030	- .0054	+ .0020	- .0022	
% $\Delta$	.56	.05	.70	1.26	.47	.51	

Operated at 40 Watts

2	0.435	0.427	0.421	0.426	0.420	0.4258
3	.420	.424	.410	.410	.408	.4144
4	.431	.436	.411	.421	.419	.4236
6	.434	.428	.416	.420	.416	.4228
7	.431	.427	.422	.420	.419	.4238
8	.431	.432	.411	.419	.420	.4226
10	.438	.419	.417	.430	.425	.4258
12	.431	.427	.420	.421	.417	.4232
Ave	.4314	.4275	.4160	.4209	.4180	.42288
$\Delta$	+ .0086	+ .0047	- .0068	- .0019	- .0048	
% $\Delta$	2.03	1.11	1.61	.45	1.14	



Table 8

F40T12/Daylight Lamps  
Operated at 236.0 line volts

## Lamp Volts

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	101.5	102.2	102.5	104.2	102.2	104.9	102.9
3	105.0	104.8	102.8	107.1	105.1	106.7	105.2
4	102.7	102.8	100.5	105.9	102.8	104.5	103.2
6	102.4	102.5	101.5	105.9	103.3	105.1	103.4
7	103.9	103.1	100.7	104.0	103.5	105.2	103.4
8	103.3	103.0	100.8	104.1	104.0	106.4	103.6
10	101.5	102.0	103.0	105.0	101.6	104.6	103.0
12	<u>103.0</u>	<u>103.0</u>	<u>102.0</u>	<u>105.2</u>	<u>103.1</u>	<u>106.1</u>	<u>103.7</u>
Ave	102.9	102.9	101.7	105.2	103.2	105.4	103.5
$\Delta$	- .6	- .6	- 1.8	+ 1.7	- .3	+ 1.9	
% $\Delta$	.58	.58	1.74	1.64	.29	1.84	

## Operated at 40 Watts

2		102.1	102.5	104.9	102.8	105.6	103.6
3		104.9	102.7	108.1	106.4	107.6	105.9
4		102.8	100.5	106.1	103.6	105.9	103.8
6		102.1	101.8	105.9	104.2	106.0	104.0
7		103.0	100.5	104.0	104.1	105.6	103.4
8		102.7	101.0	104.1	104.6	105.1	103.5
10		101.0	103.7	104.9	102.0	104.6	103.2
12		<u>103.0</u>	<u>102.3</u>	<u>105.2</u>	<u>104.0</u>	<u>106.1</u>	<u>104.1</u>
Ave		102.7	101.9	105.4	104.0	105.8	103.9
$\Delta$		- 1.2	- 2.0	+ 1.5	+ .1	+ 1.9	
% $\Delta$		1.15	1.92	1.44	.10	1.83	



Table 9

F40T12/Daylight Lamps  
Operated at 236.0 line volts

Watts

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	39.9	39.6	40.5	40.9	40.2	40.4	40.2
3	41.0	40.4	40.5	41.9	41.4	41.2	41.1
4	40.2	40.0	39.8	41.5	40.7	40.5	40.4
6	40.1	39.7	40.3	40.5	40.6	40.7	40.3
7	40.5	39.9	39.7	40.0	40.9	40.9	40.3
8	40.4	39.8	40.1	40.1	41.1	41.0	40.4
10	39.8	39.3	40.8	41.0	40.0	40.3	40.2
12	<u>40.1</u>	<u>39.9</u>	<u>40.2</u>	<u>40.5</u>	<u>40.7</u>	<u>41.0</u>	<u>40.4</u>
Ave	40.3	39.8	40.2	40.8	40.7	40.8	40.4
$\Delta$	- .1	- .6	- .2	+ .4	+ .3	+ .4	
% $\Delta$	.25	1.49	.50	.99	.74	.99	





Table 10

F40T12/Daylight Lamps  
Operated at 236.0 line volts

Lumens per Watt

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	56.5	57.2	56.2	54.1	57.5	56.2	56.3
3	54.4	56.1	56.7	52.8	55.5	54.8	55.0
4	56.1	56.9	57.9	54.0	57.1	56.1	56.4
6	55.8	56.9	56.0	53.7	56.6	54.9	55.6
7	55.1	56.4	57.7	54.8	56.0	55.3	56.0
8	55.2	56.8	57.3	54.9	55.3	54.9	55.7
10	56.1	57.6	55.5	53.3	57.3	56.2	56.0
12	56.0	56.6	57.4	55.1	56.6	55.3	56.2
Ave	55.7	56.8	56.8	54.1	56.5	55.5	55.9
$\Delta$	- .2	+ .9	+ .9	-1.8	+ .6	- .4	
% $\Delta$	.36	1.61	1.61	3.22	1.07	.72	

Operated at 40 Watts

2	57.2	56.5	54.7	57.2	55.6	56.2
3	56.2	56.7	53.4	55.7	54.5	55.3
4	57.0	57.9	54.1	57.1	56.0	56.4
6	56.9	56.1	54.0	56.5	54.3	55.6
7	56.6	57.6	54.8	56.2	55.5	56.1
8	56.8	57.3	54.8	55.6	55.3	56.0
10	57.4	55.5	51.9	57.2	56.2	55.6
12	56.8	57.2	55.4	56.7	55.4	56.3
Ave	56.9	56.8	54.1	56.5	55.4	55.9
$\Delta$	+1.0	+ .9	-1.8	+ .6	- .5	
% $\Delta$	1.79	1.61	3.22	1.07	.89	



Table 11

F40T12/Pink Lamps  
Operated at 236.0 line volts

## Lumens

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	1264	1130	1046	1211	1028	1176	1142
3	1100	940	892	1016	853	983	964
4	1347	1206	1116	1286	1109	1255	1220
5	1386	1234	1166	1331	1149	1308	1262
6	<u>1320</u>	<u>1174</u>	<u>1086</u>	<u>1275</u>	<u>1088</u>	<u>1243</u>	<u>1198</u>
Ave	1283	1137	1061	1224	1045	1193	1157
$\Delta$	+126	- 20	- 96	+ 67	-112	+ 36	
% $\Delta$	10.9	1.7	8.3	5.8	9.7	3.1	

## Operated at 40 Watts

2	1154	1058	1211	1025	1182	1126
3	960	908	1006	851	972	939
4	1232	1142	1280	1113	1250	1203
5	1234	1178	1331	1140	1294	1235
6	<u>1190</u>	<u>1098</u>	<u>1265</u>	<u>1076</u>	<u>1241</u>	<u>1174</u>
Ave	1154	1077	1219	1041	1188	1136
$\Delta$	+ 18	- 59	+ 83	- 95	+ 52	
% $\Delta$	1.6	5.2	7.3	8.4	4.6	



Table 12

F40T12/Pink Lamps

Operated at 236.0 line volts

## Amperes

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	0.433	0.433	0.434	0.429	0.434	0.431	0.4323
3	.434	.432	.435	.429	.433	.431	.4323
4	.432	.428	.431	.427	.433	.430	.4302
5	.431	.428	.431	.426	.431	.428	.4292
6	.434	.430	.435	.426	.433	.429	.4312
Ave	<u>.4328</u>	<u>.4302</u>	<u>.4332</u>	<u>.4274</u>	<u>.4328</u>	<u>.4298</u>	<u>.4310</u>
$\Delta$	+ .0018	- .0008	+ .0022	- .0036	+ .0018	- .0012	
% $\Delta$	.42	.19	.51	.84	.42	.28	

## Operated at 40 Watts

2	0.445	0.440	0.429	0.433	0.434	0.4362
3	.443	.449	.427	.432	.425	.4352
4	.443	.447	.425	.436	.430	.4362
5	.428	.437	.429	.427	.425	.4292
6	<u>.440</u>	<u>.442</u>	<u>.425</u>	<u>.429</u>	<u>.431</u>	<u>.4334</u>
Ave	.4398	.4430	.4270	.4314	.4290	.4340
$\Delta$	+ .0058	+ .0090	- .0070	- .0026	- .0050	
% $\Delta$	1.34	2.07	1.61	.60	1.15	



Table 13

F40T12 Pink Lamps  
Operated at 236.0 line volts

Lamp Volts

<u>Lamp No.</u>	<u>West</u>	<u>Champ</u>	<u>Syl</u>	<u>El Tronics</u>	<u>GE</u>	<u>Duro T</u>	<u>Ave</u>
2	100.8	100.0	99.7	103.2	100.6	101.8	101.0
3	101.2	101.0	99.3	103.0	100.9	103.1	101.4
4	100.5	101.0	99.8	103.9	100.3	103.1	101.4
5	102.0	102.9	100.6	103.1	101.8	103.7	102.4
6	<u>101.3</u>	<u>101.8</u>	<u>99.4</u>	<u>104.0</u>	<u>101.6</u>	<u>103.6</u>	<u>102.0</u>
Ave	101.2	101.3	99.8	103.4	101.0	103.1	101.6
$\Delta$	- .4	- .3	- 1.8	+ 1.8	- .6	+ 1.5	
$\% \Delta$	.39	.30	1.77	1.77	.59	1.48	

Operated at 40 Watts

2	99.5	99.5	102.1	100.9	102.5	100.9
3	100.2	99.0	103.5	101.1	104.0	101.6
4	100.0	98.5	104.0	100.5	103.5	101.3
5	102.9	100.2	103.0	102.2	104.1	102.5
6	<u>101.0</u>	<u>99.0</u>	<u>104.0</u>	<u>101.7</u>	<u>102.6</u>	<u>101.7</u>
Ave	100.7	99.2	103.3	101.3	103.3	101.6
$\Delta$	- .9	-2.4	+ 1.7	- .3	+ 1.7	
$\% \Delta$	.89	2.36	1.67	.30	1.67	





Table 14

F40T12/Pink Lamps  
Operated at 236.0 line volts

Watts

Lamp No.	West	Champ	Syl	El Tronics	GE	Duro T	Ave
2	39.7	39.1	39.6	40.0	40.0	39.8	39.7
3	39.8	39.2	39.3	40.5	40.0	40.1	39.8
4	39.3	38.8	39.2	40.4	39.5	40.0	39.5
5	40.0	40.0	39.6	40.0	40.3	40.1	40.0
6	<u>39.8</u>	<u>39.4</u>	<u>39.6</u>	<u>40.2</u>	<u>40.3</u>	<u>40.1</u>	<u>39.9</u>
Ave	39.7	39.3	39.5	40.2	40.0	40.0	39.8
$\Delta$	- .1	- .5	- .3	+ .4	+ .2	+ .2	
% $\Delta$	.25	1.26	.75	1.00	.50	.50	

Table 15

F40T12/Pink Lamps  
Operated at 236.0 line volts

Lumens per Watt

2	31.8	28.9	26.4	30.3	25.7	29.5	28.8
3	27.6	24.0	22.7	25.1	21.3	24.5	24.2
4	34.3	31.1	28.5	31.8	28.1	31.4	30.9
5	34.7	30.9	29.4	33.3	28.5	32.6	31.6
6	<u>33.2</u>	<u>29.8</u>	<u>27.4</u>	<u>31.7</u>	<u>27.0</u>	<u>31.0</u>	<u>30.0</u>
Ave	32.3	28.9	26.9	30.4	26.1	29.8	29.1
$\Delta$	+3.2	- .2	-2.2	+1.3	-3.0	+ .7	
% $\Delta$	11.0	.7	7.6	4.5	10.3	2.4	

Operated at 40 Watts

2	28.9	26.4	30.3	25.6	29.6	28.2
3	24.0	22.7	25.2	21.3	24.3	23.5
4	30.8	28.5	32.0	27.8	31.2	30.2
5	30.9	29.4	33.3	28.5	32.4	30.9
6	<u>29.8</u>	<u>27.4</u>	<u>31.6</u>	<u>26.9</u>	<u>31.0</u>	<u>29.3</u>
Ave	28.9	26.9	30.5	26.0	29.7	28.4
$\Delta$	+ .5	-1.5	+2.1	-2.4	+1.3	
% $\Delta$	1.8	5.3	7.4	8.5	4.6	



Figure 1

F40T12/Cool White Lamps  
operated at 236.0 line volts

Lumens

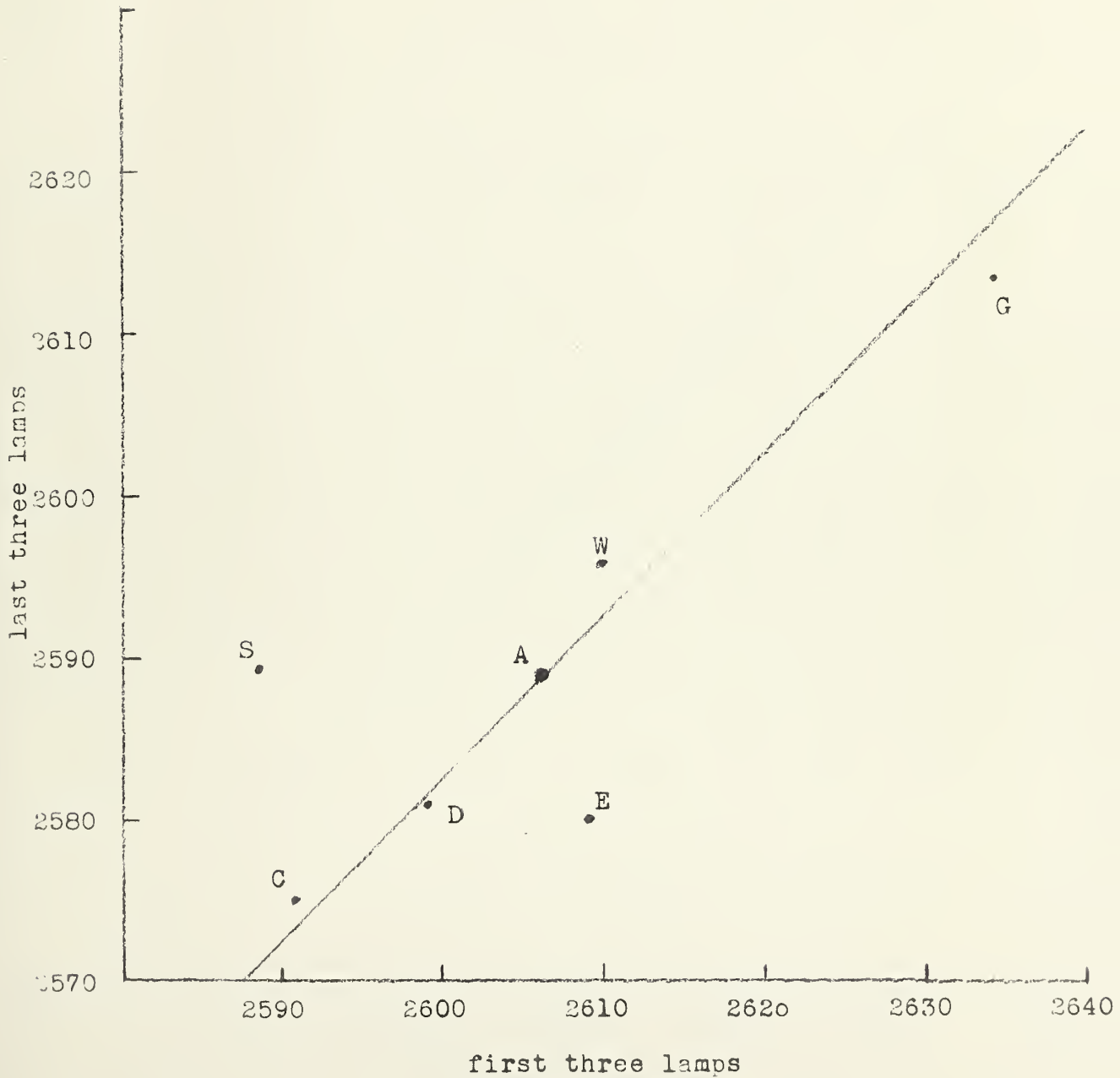




Figure 2

F40T12/Cool White Lamps  
operated at 40 watts

Lumens

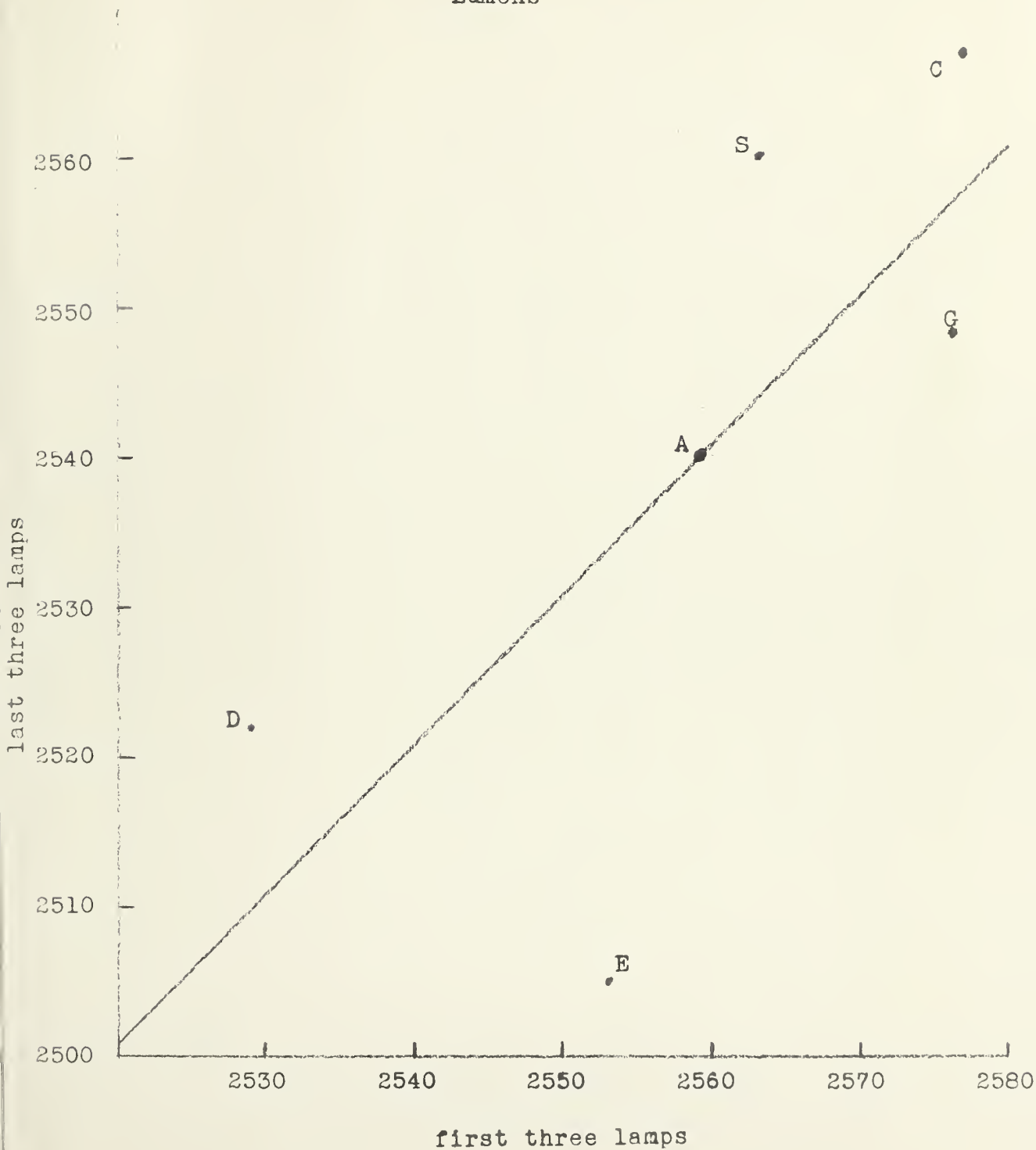




Figure 3

F40T12/Daylight Lamps  
operated at 236.0 line volts

Lumens

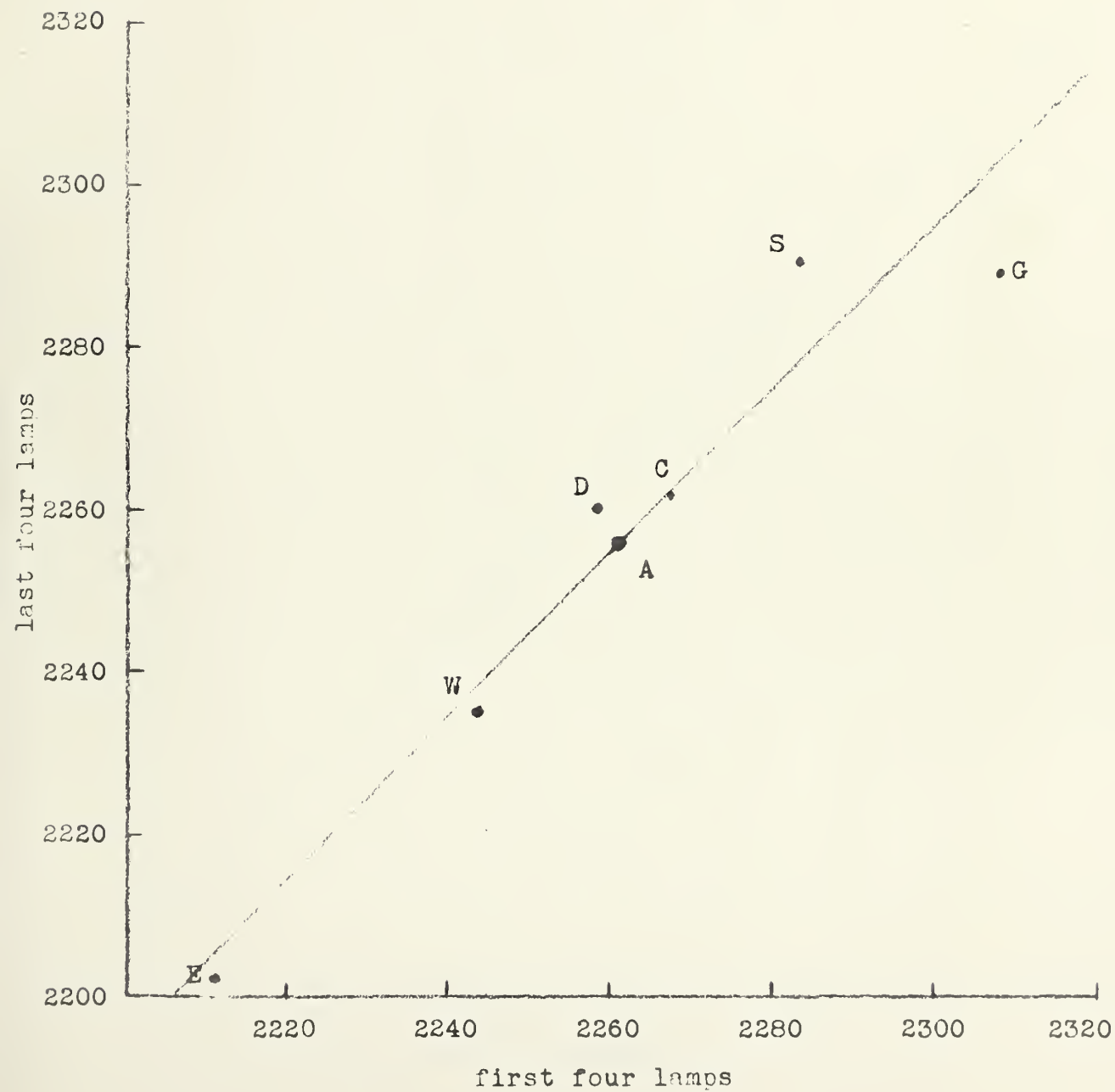






Figure 4  
F40T12/Daylight Lamps  
operated at 40 watts

Lumens

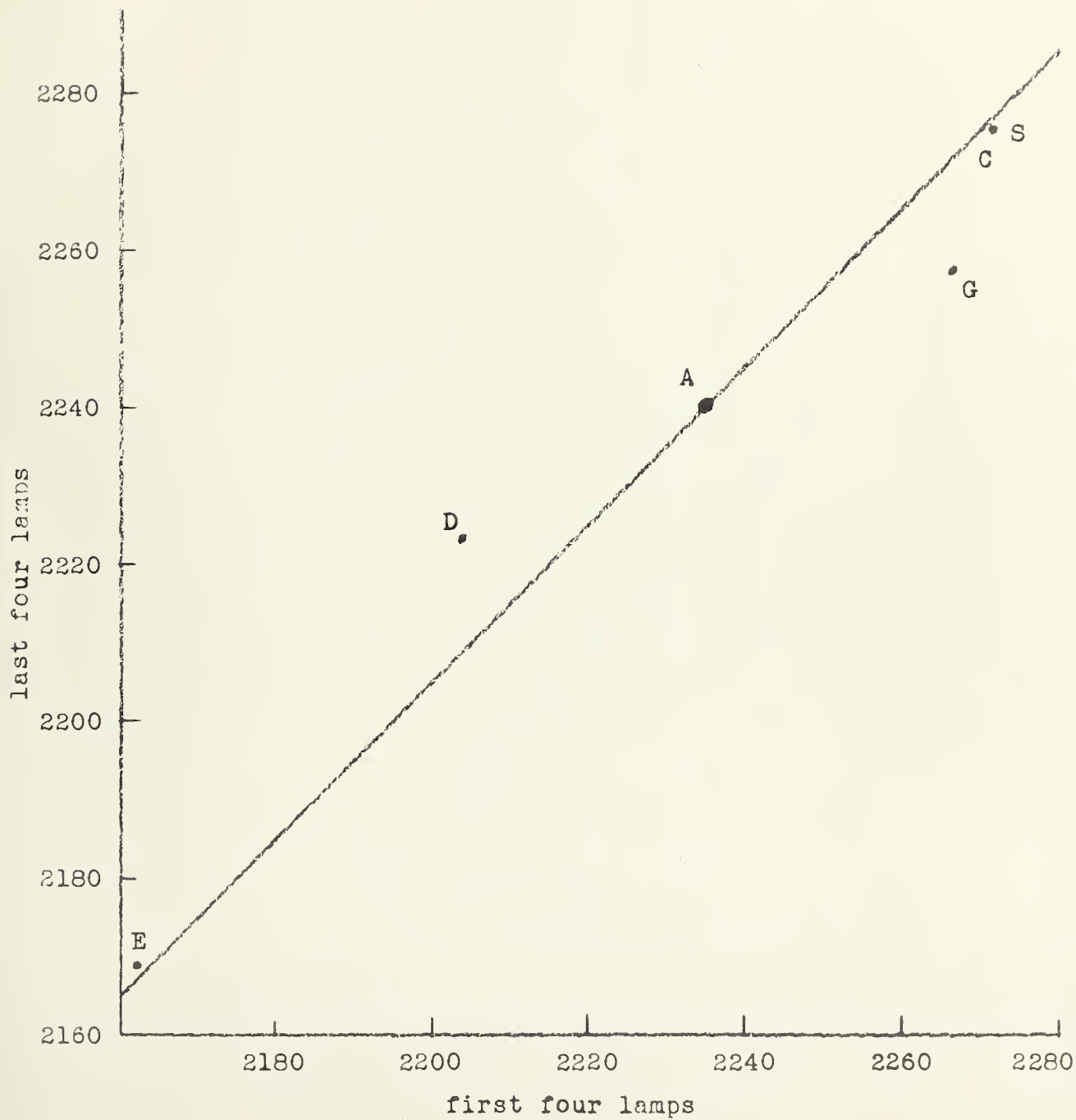




Figure 5  
F40T12/Pink Lamps  
operated at 236.0 line volts

Lumens

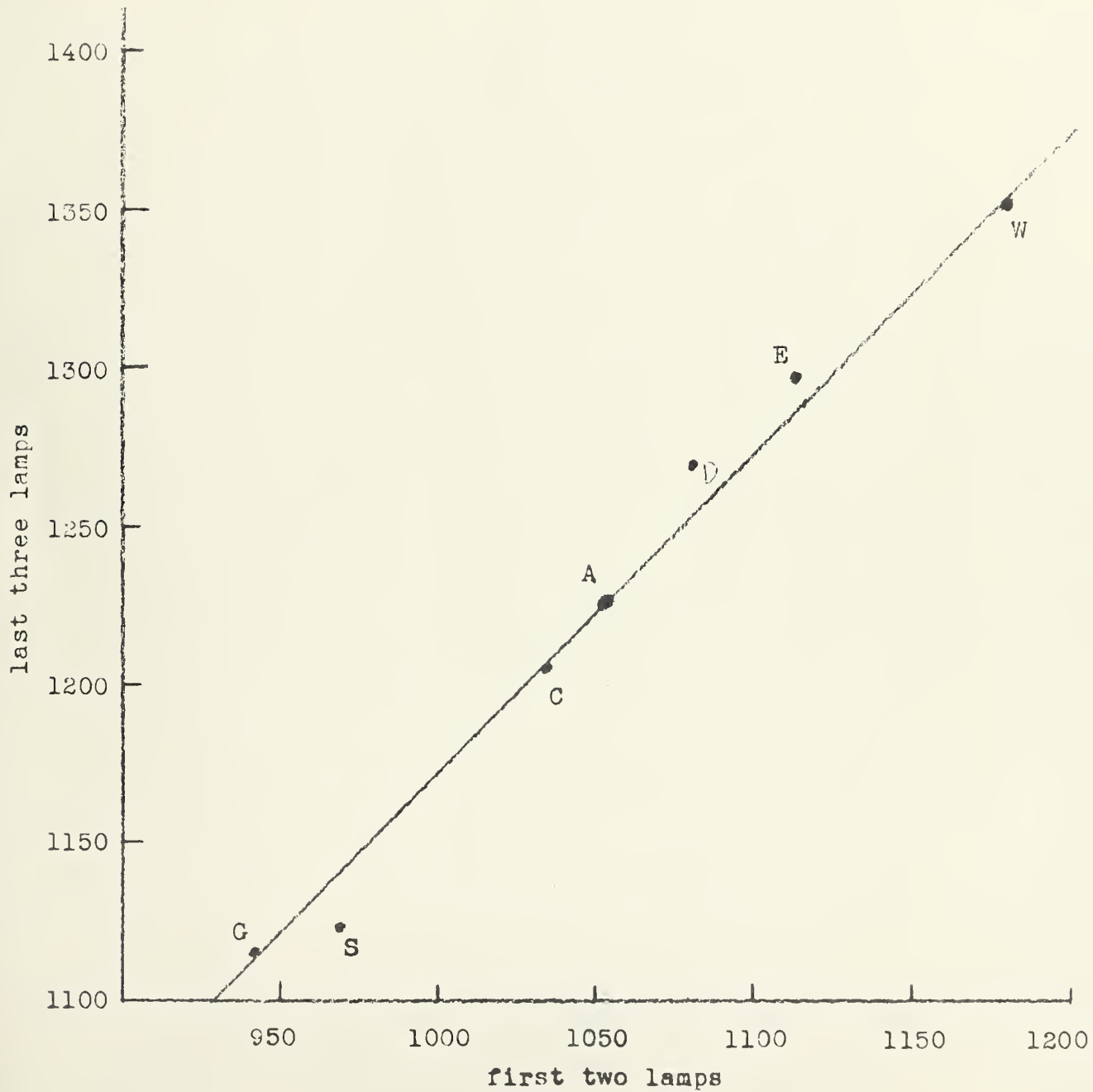




Figure 6

F40T12/Pink Lamps  
operated at 40 watts

Lumens

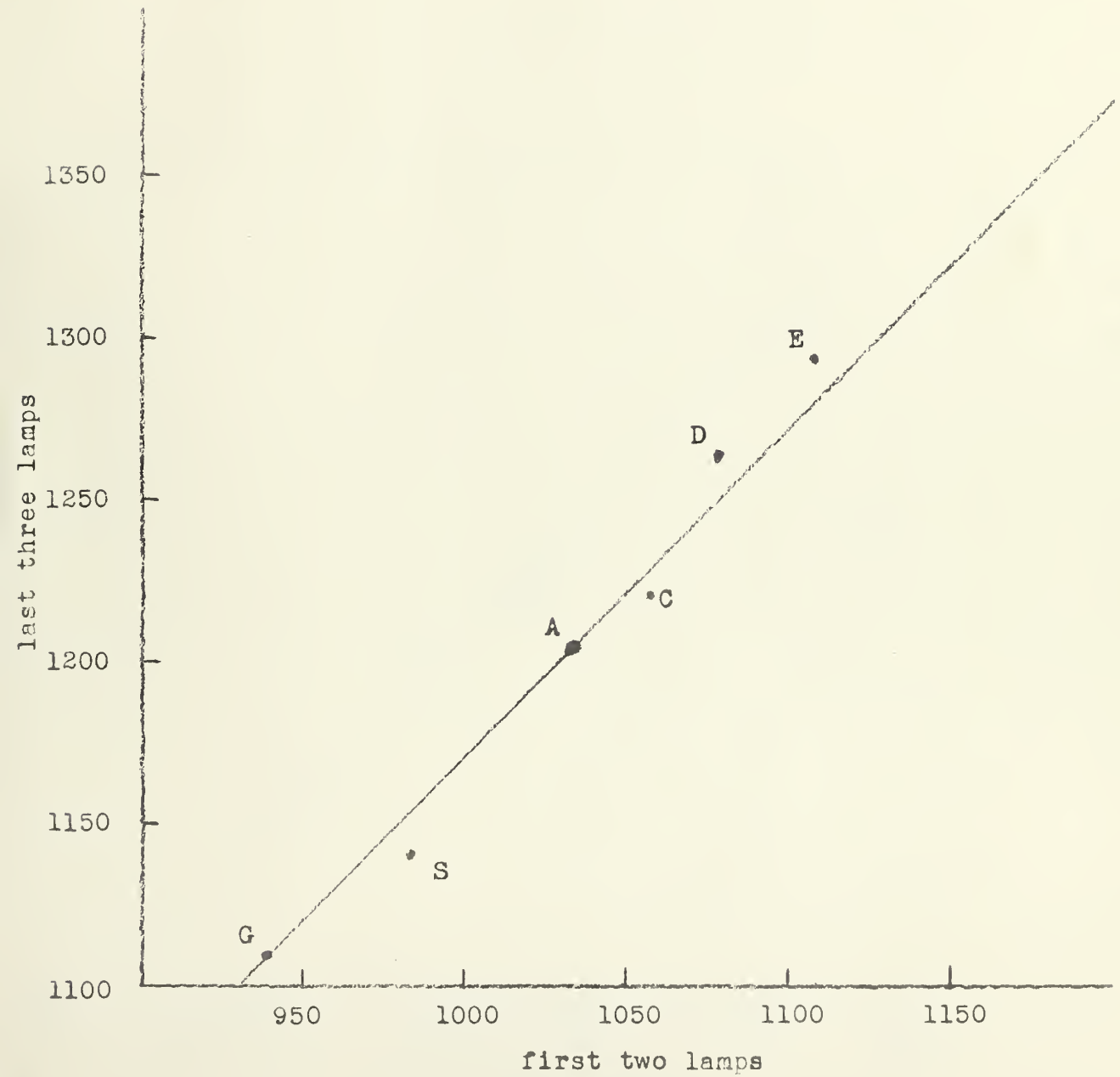




Figure 7

F40T12/Cool White Lamps  
operated at 236.0 line volts

Amperes

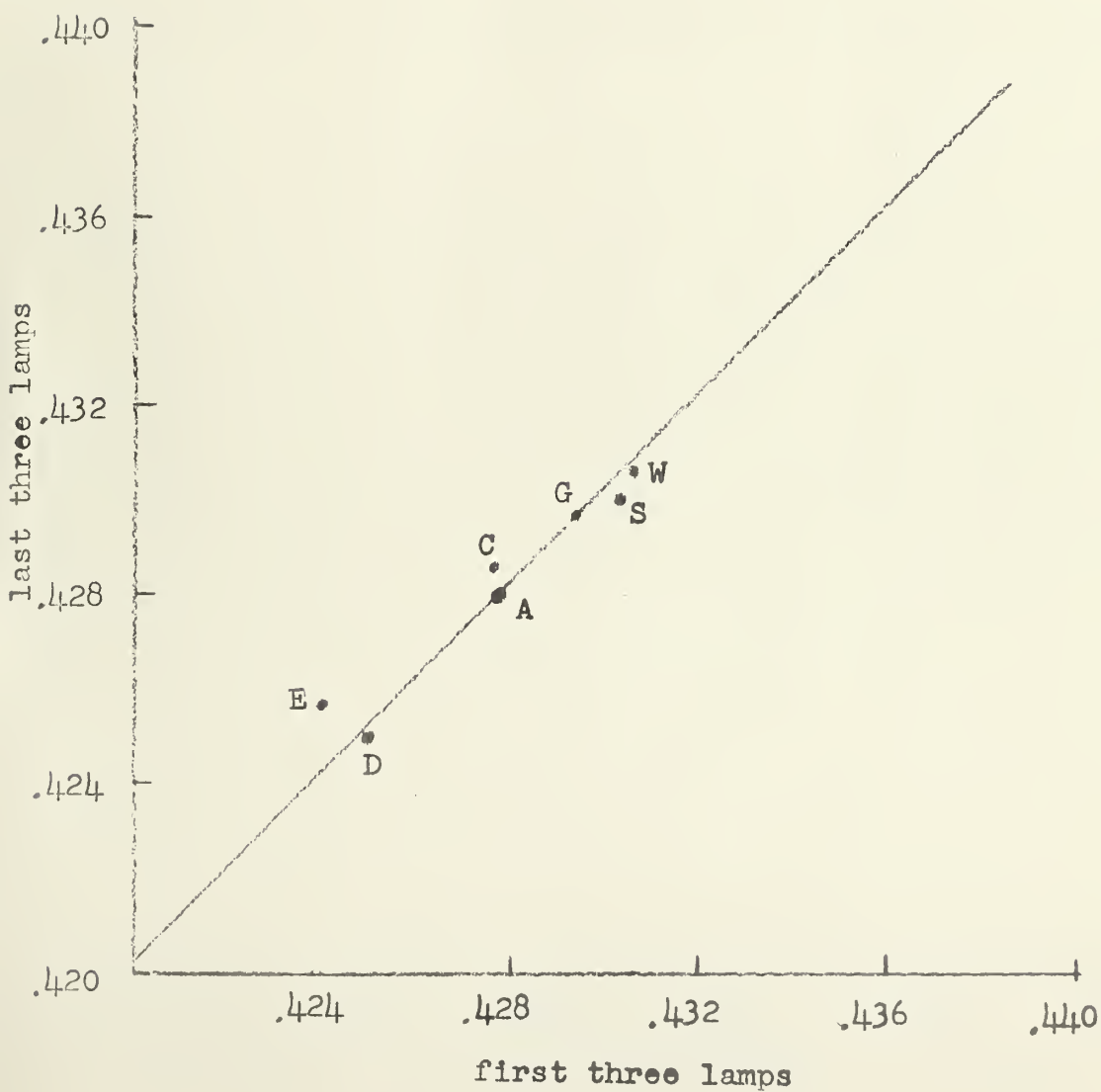






Figure 8

F40Ti2/Cool White Lamps  
operated at 4.0 watts

Amperes

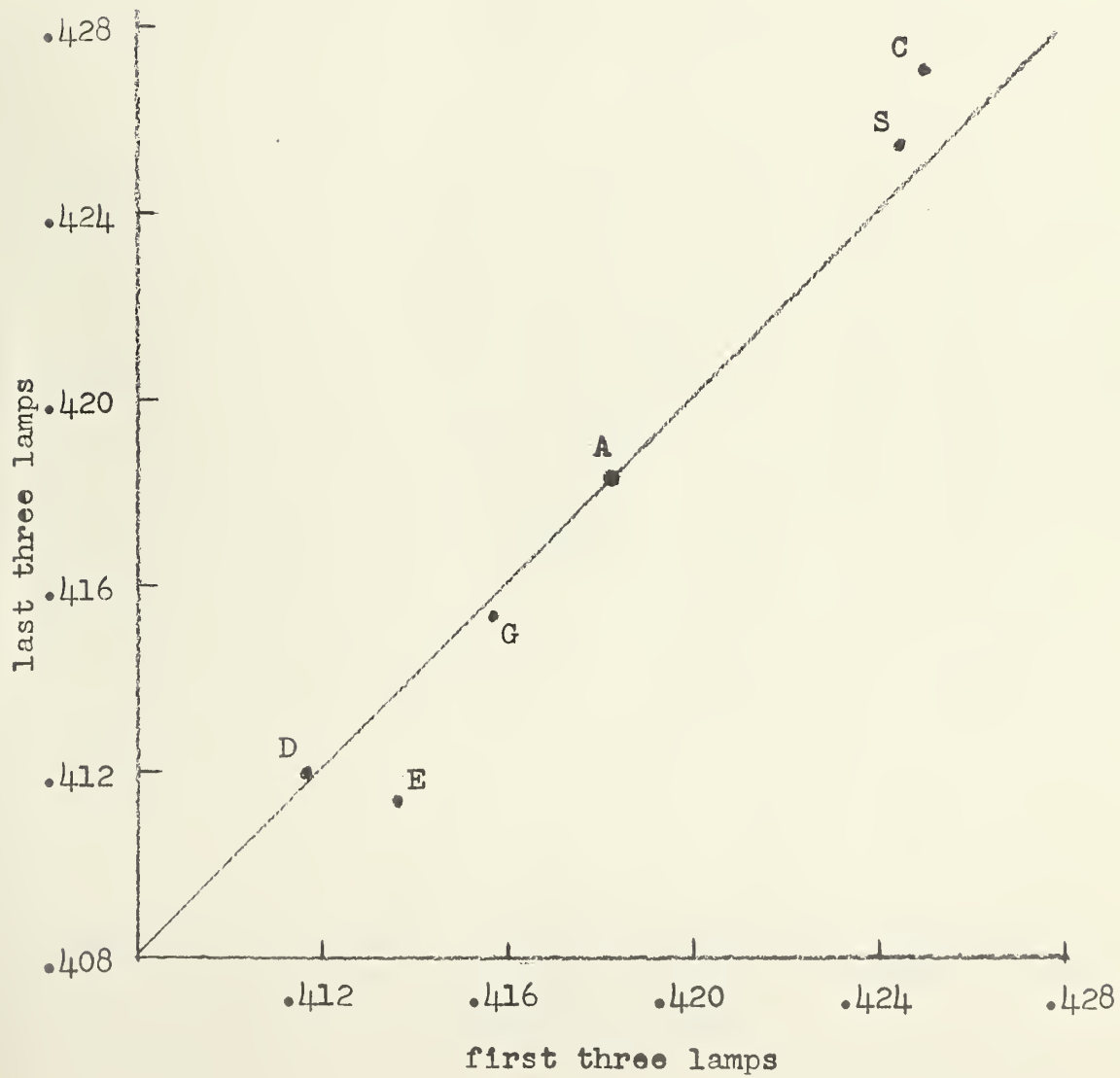




Figure 9

F40T12/Daylight Lamps  
operated at 236.0 line volts

Amperes

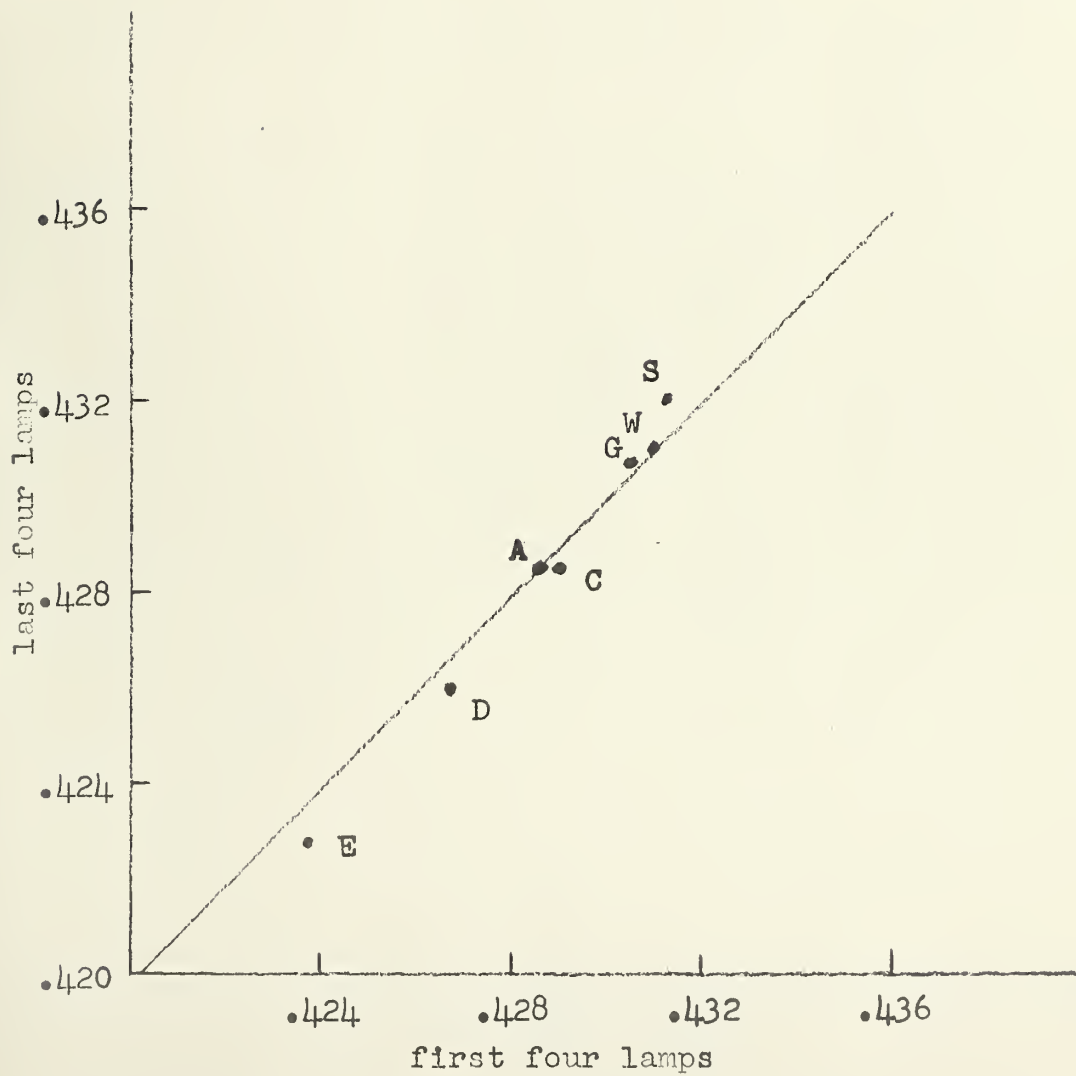




Figure 10  
F40T12/Daylight Lamps  
operated at 40 watts

Amperes

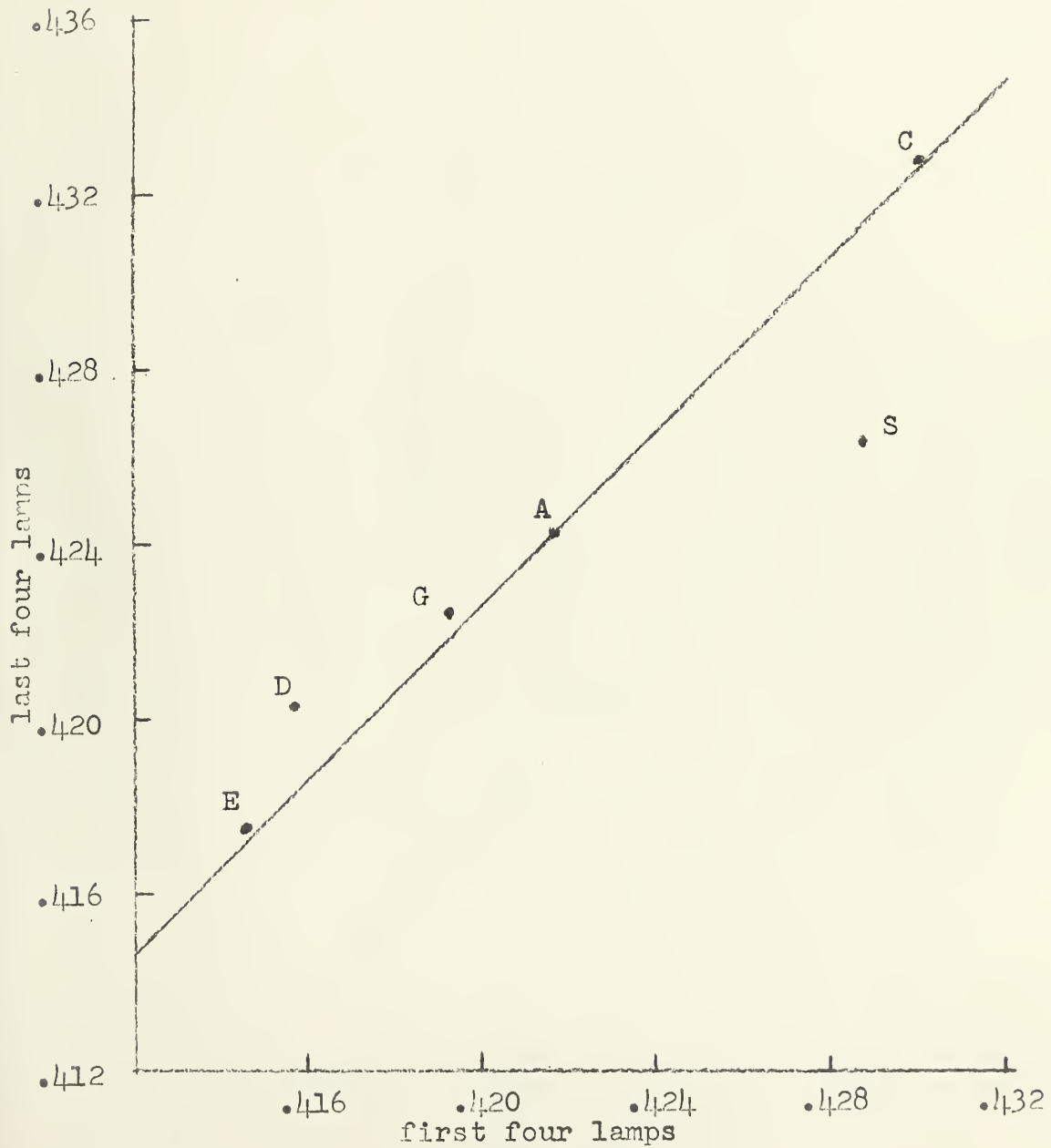




Figure 11  
F40T12/Pink Lamps  
operated at 236.0 line volts  
Amperes

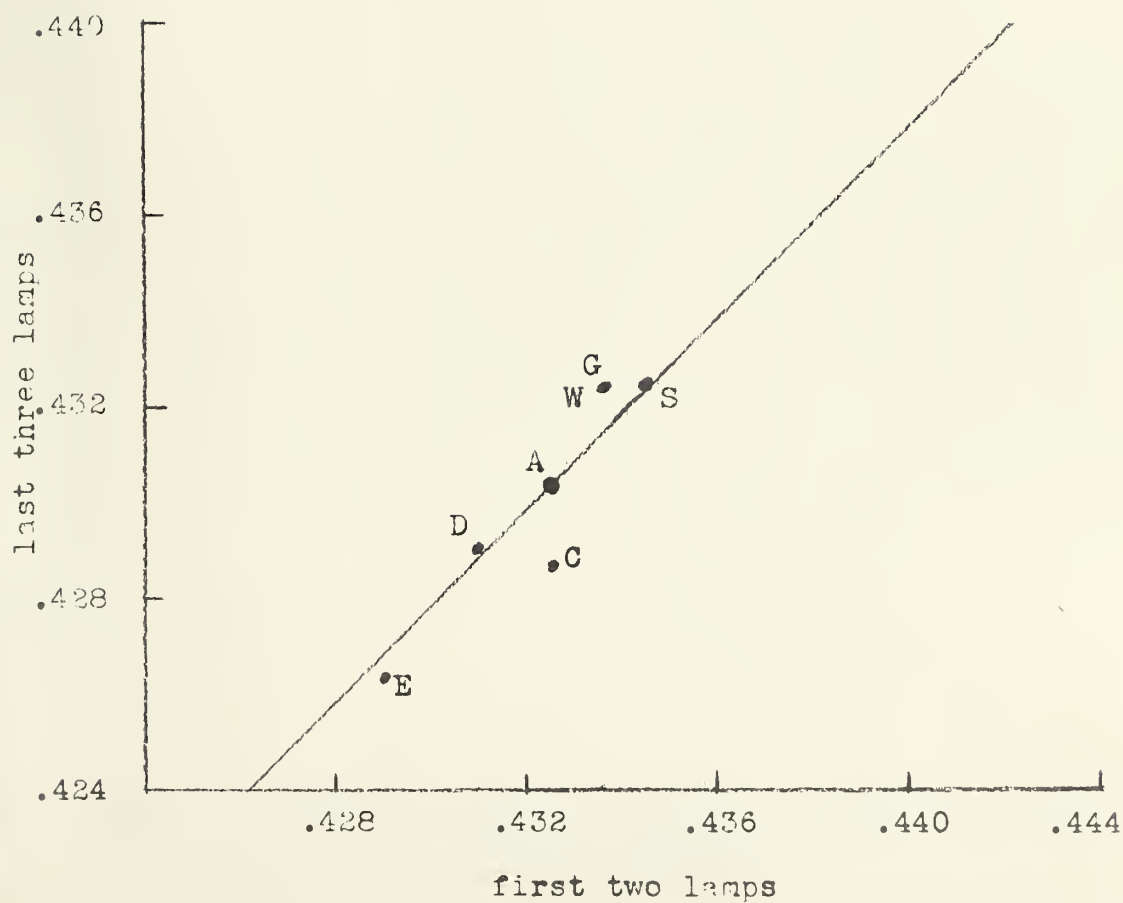






Figure 12  
F40T12/Pink Lamps  
operated at 40 watts  
Amperes

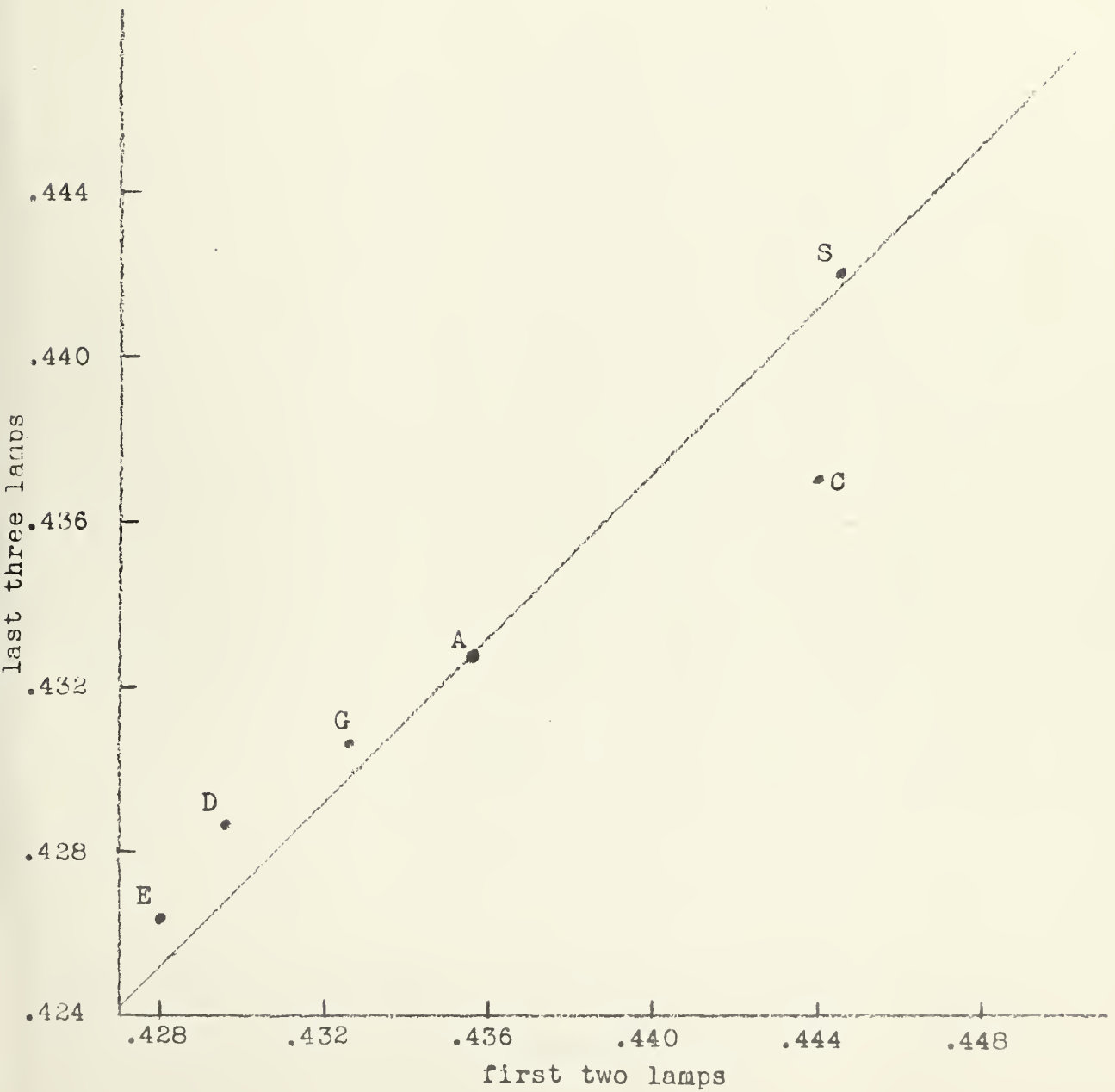




Figure 13

F40T12/Cool White Lamps  
operated at 236.0 line volts

Lamp Volts

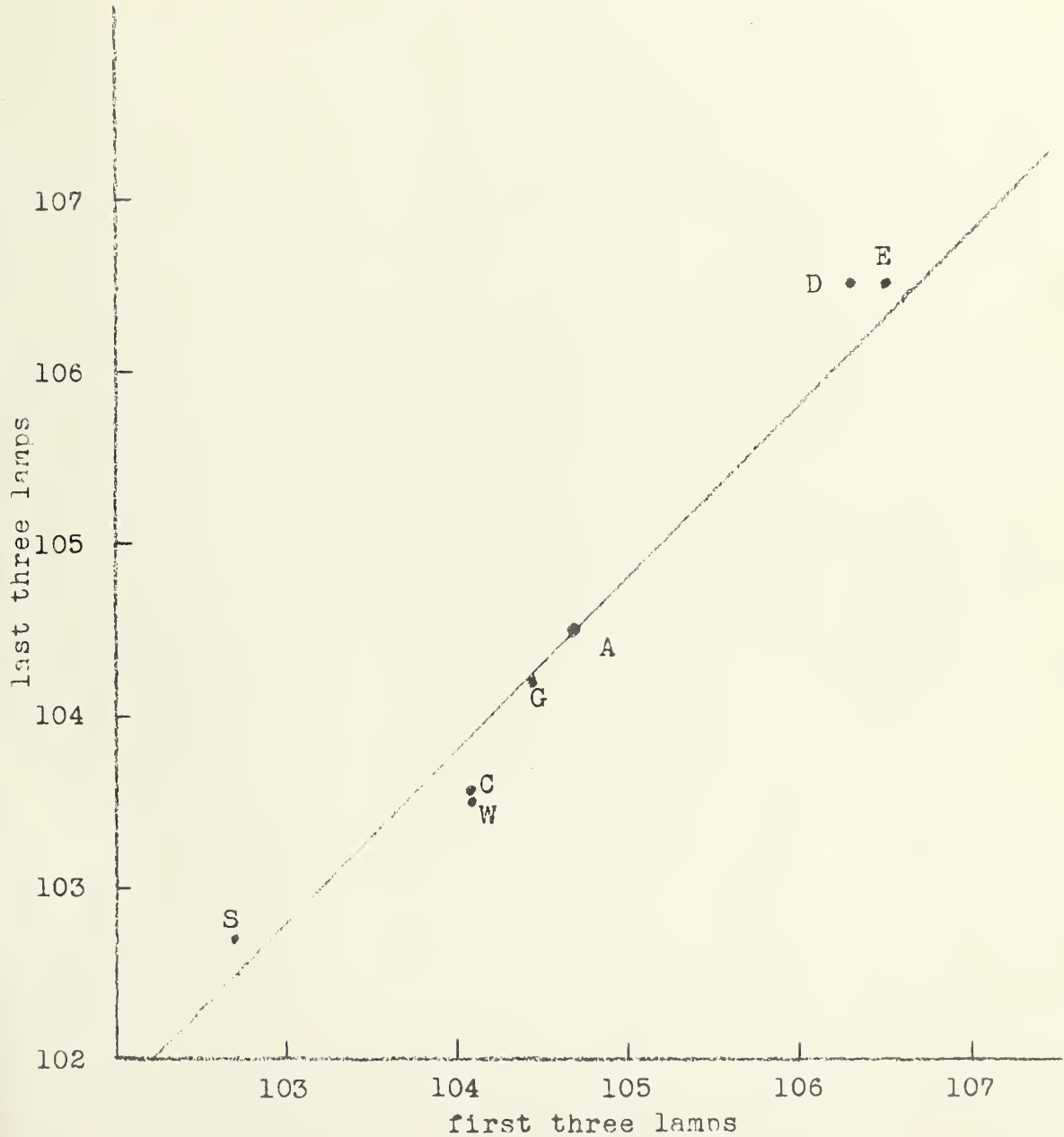




Figure 14

F40T12/Cool White Lamps  
operated at 40 watts

Lamp Volts

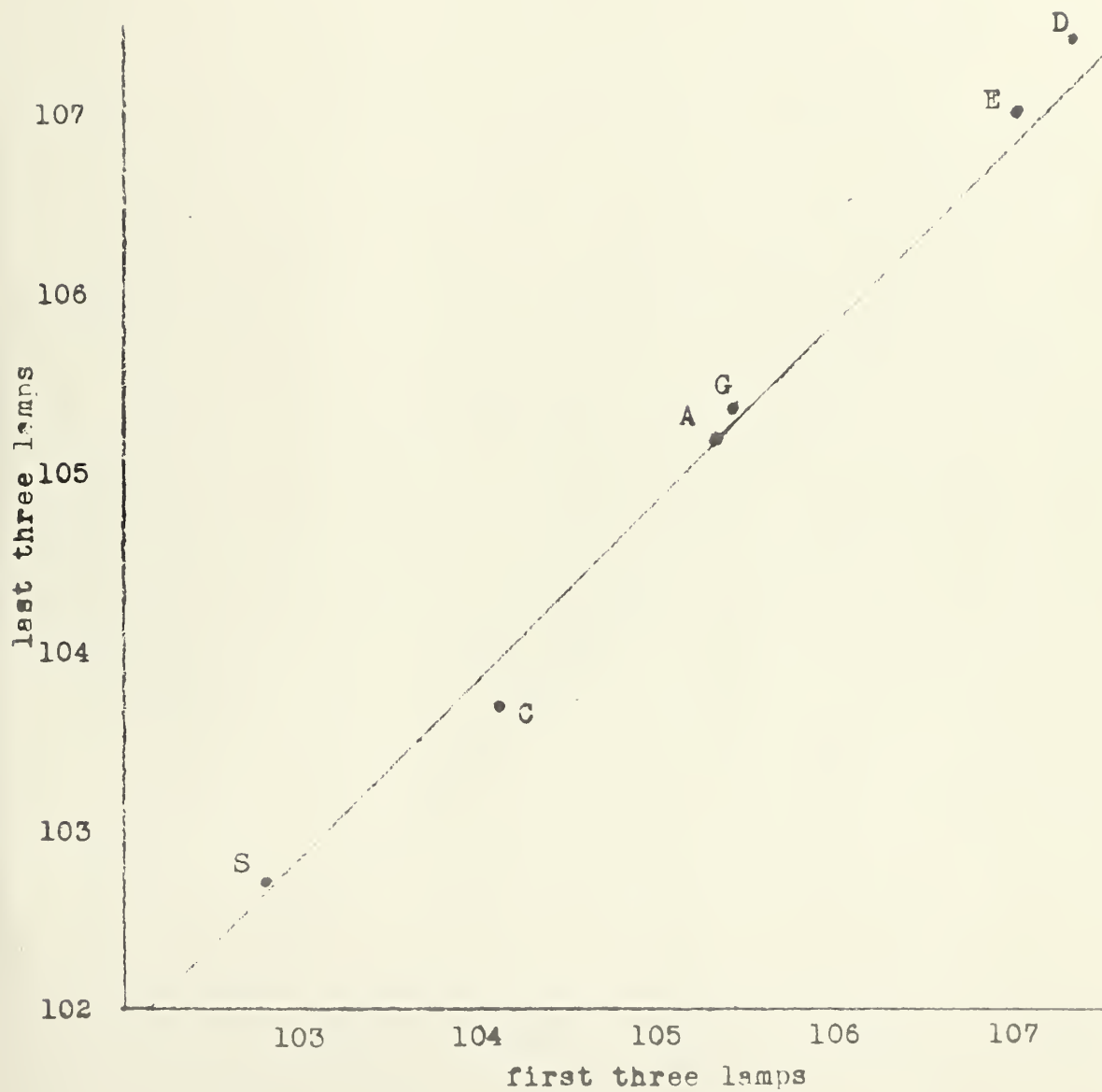
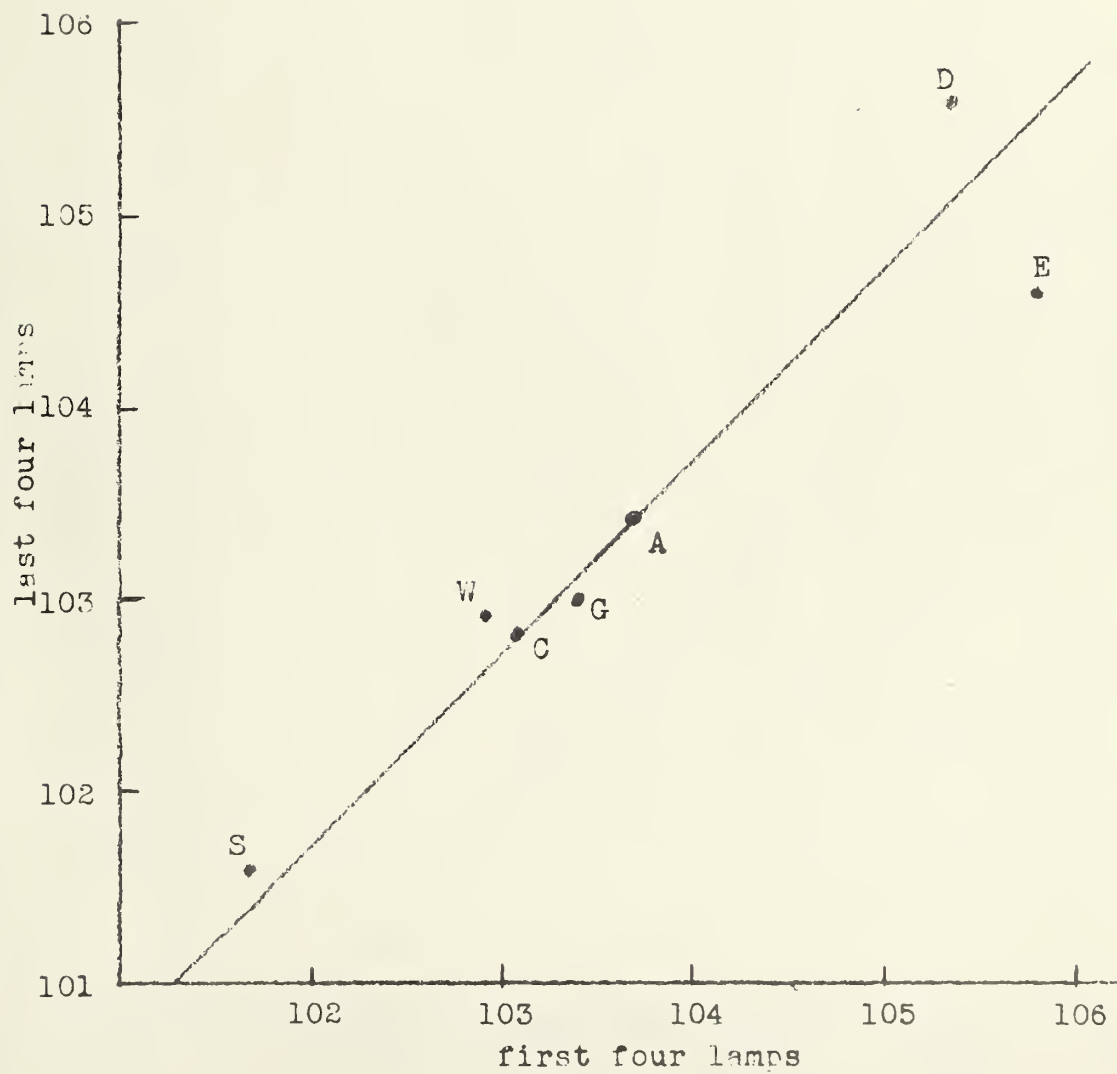




Figure 15

F40T12/Daylight Lamps  
operated at 66.0 line volts

Lamp Volts







Figurs 16

F40T12/Daylight Lamps  
operated at 40 watts

Lamp Volts

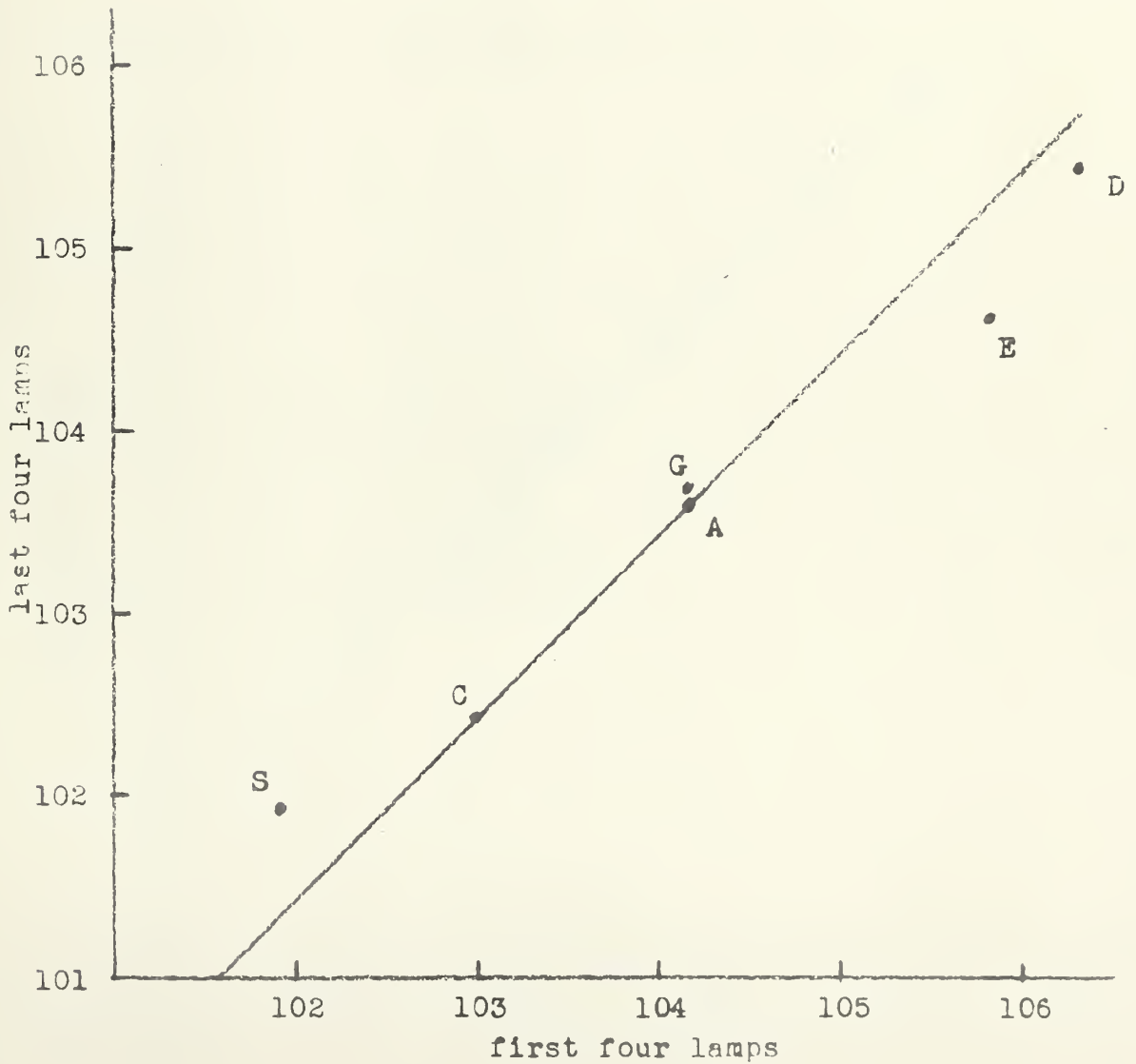




Figure 17

F40T12/Pink Lamps  
operated at 236.0 line volts

Lamp Volts

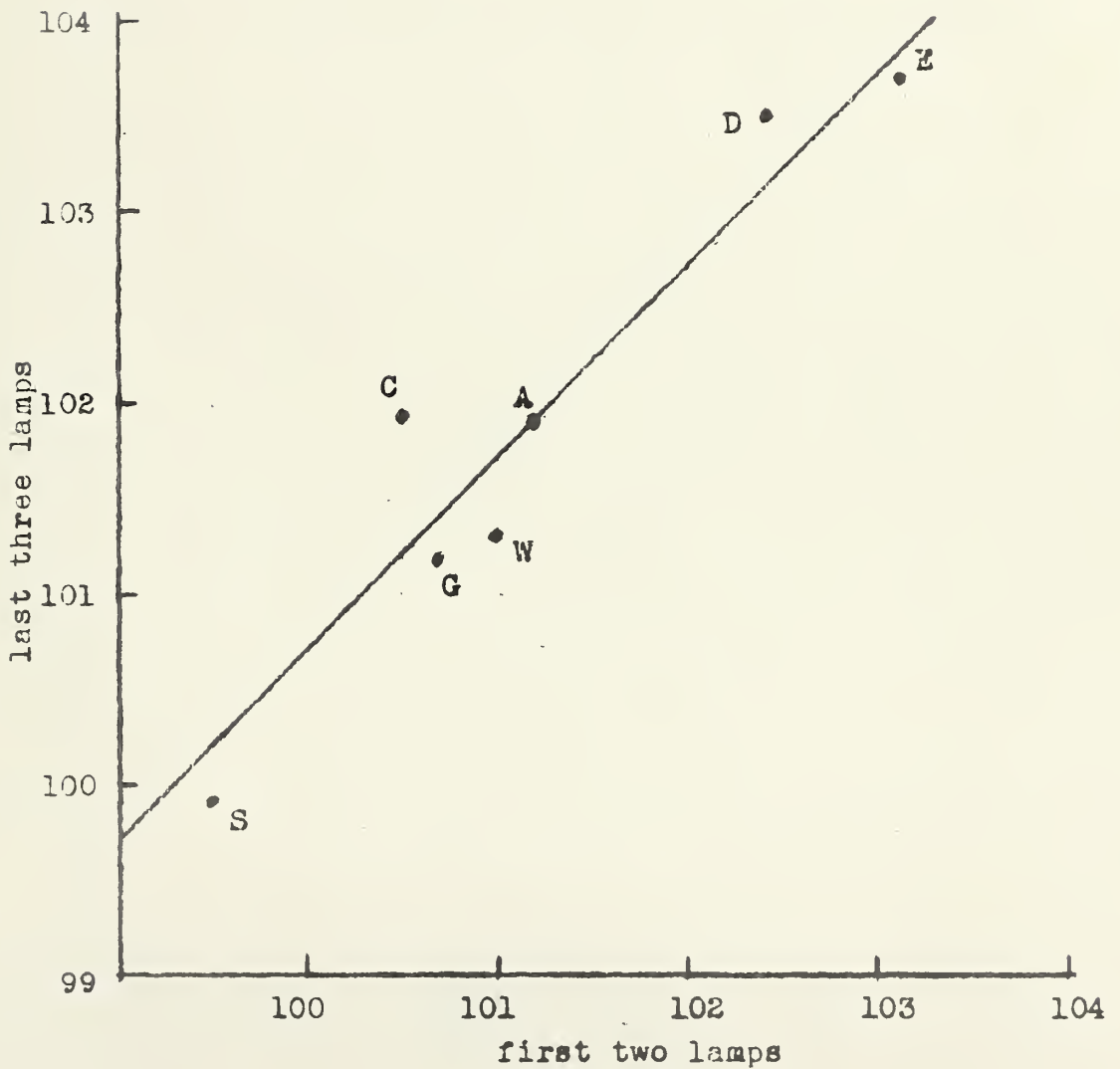




Figure 18

F40T12/Pink Lamps  
operated at 40 watts

Lamp Volts

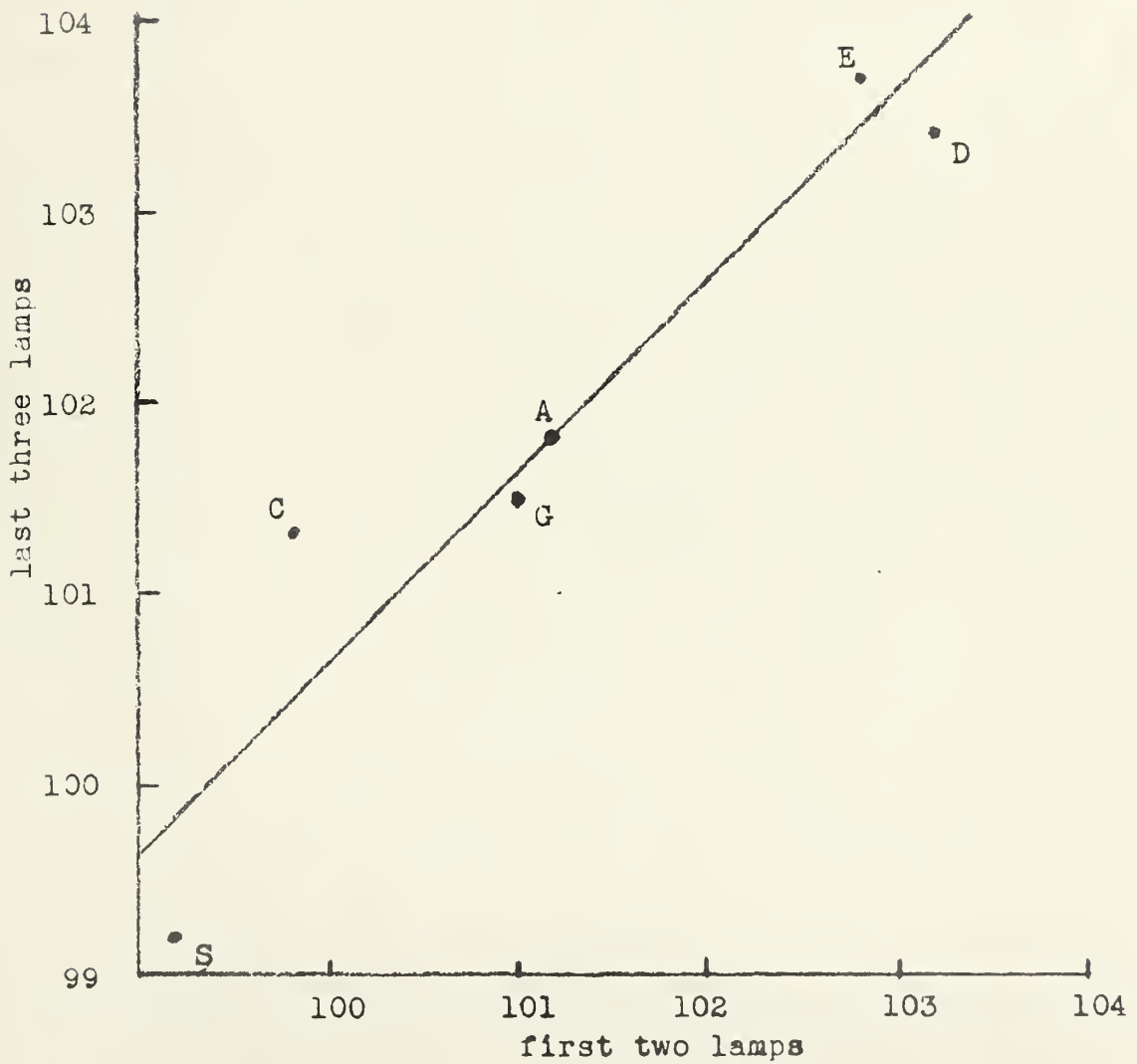




Figure 19

F40T12/Cool White Lamps  
operated at 236.0 line volts

Watts

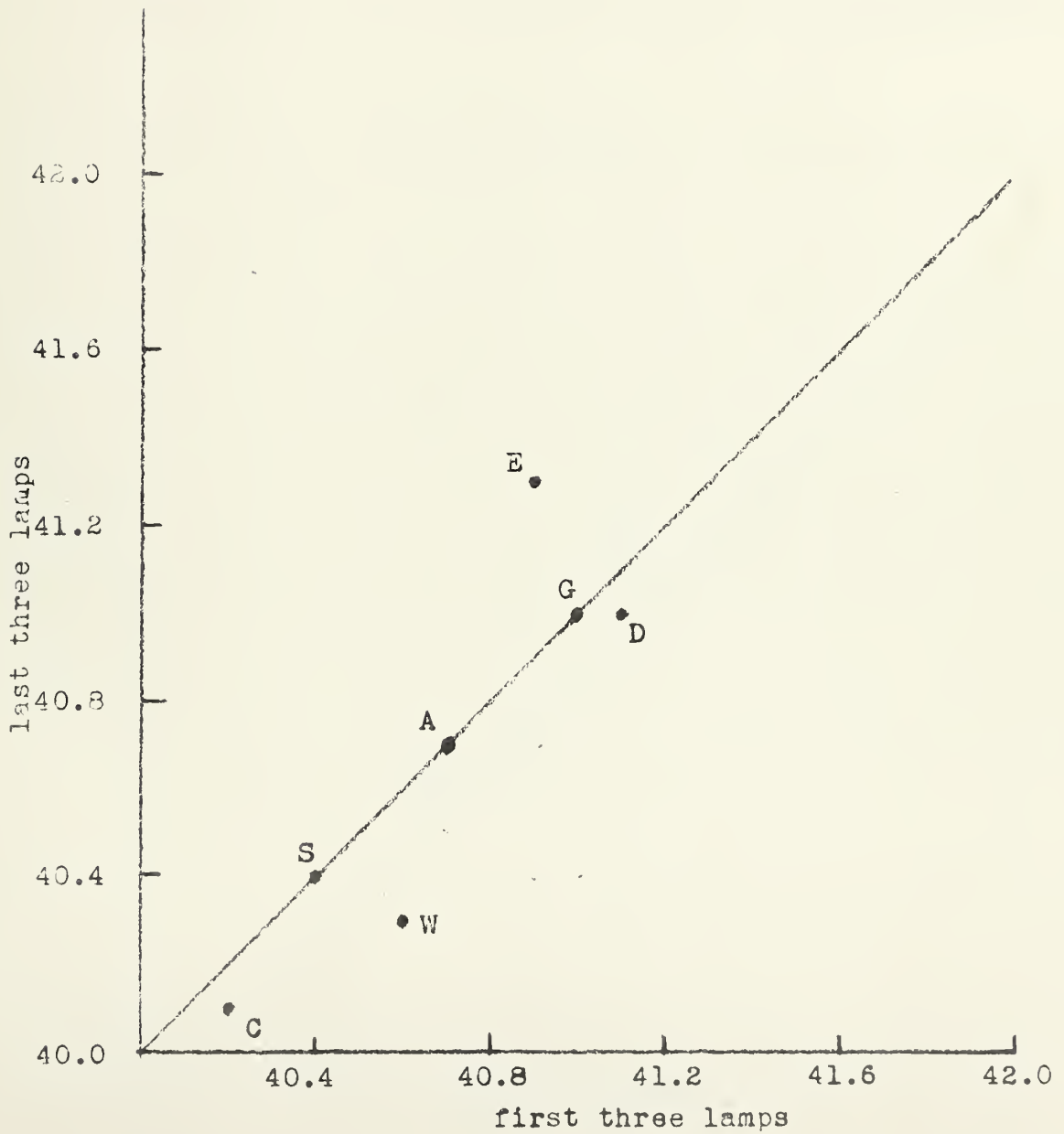






Figure 20

F40T12/Daylight Lamps  
operated at 236.0 line volts

Watts

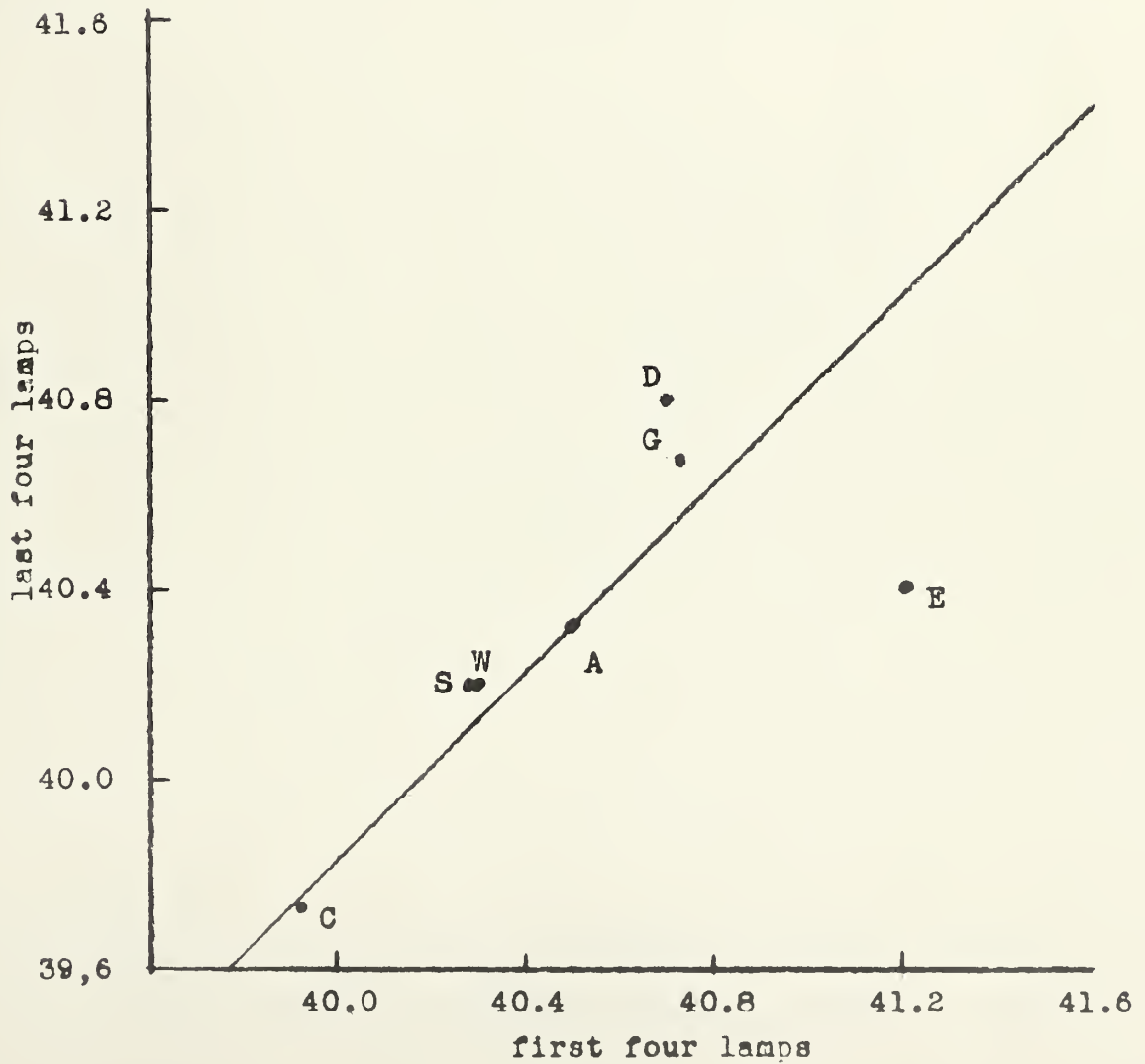




Figure 21

F40T12/Pink Lamps  
operated at 236.0 line volts

Watts

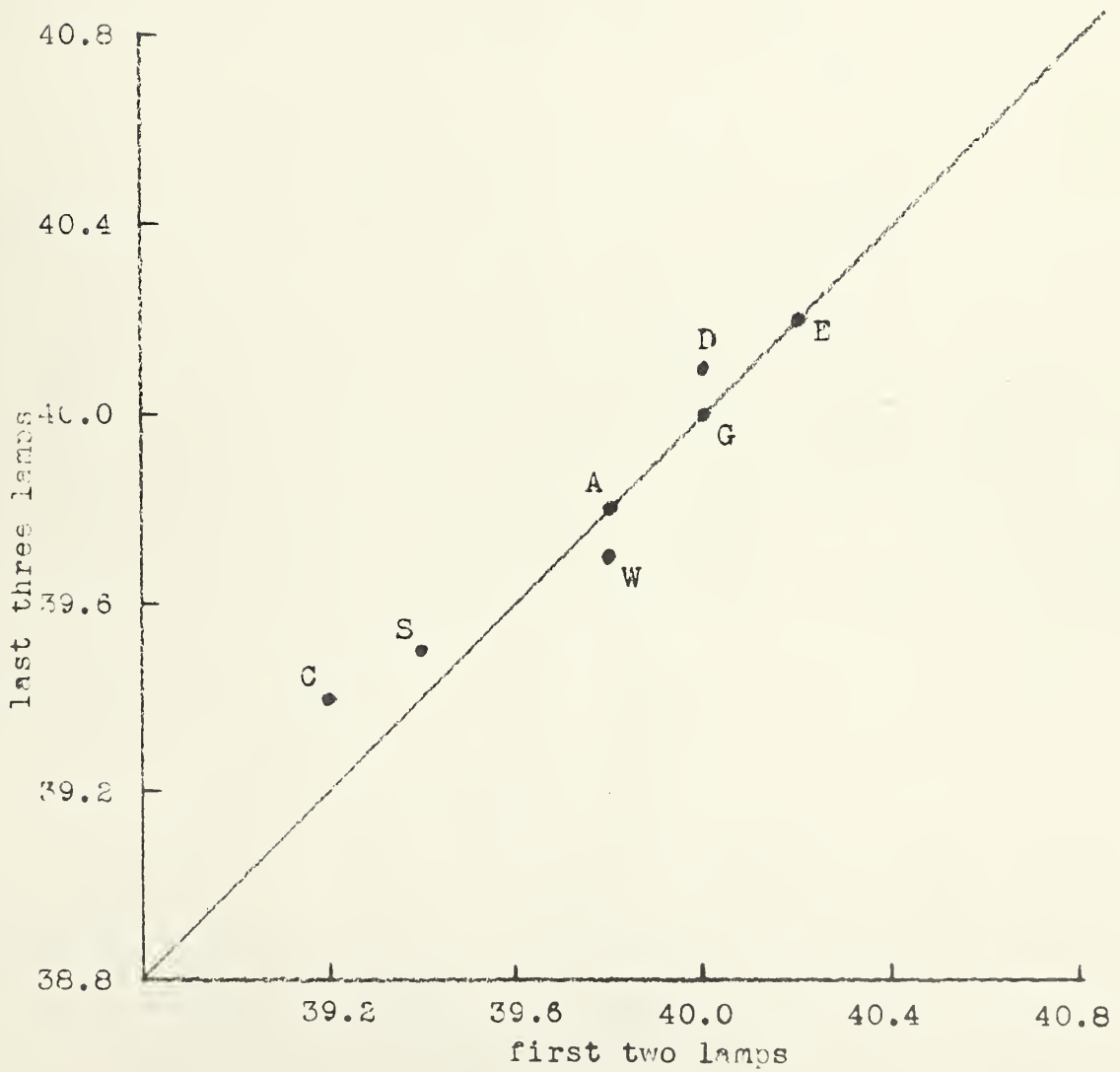




Figure 22

F40T12/Cool White Lamps  
operated at 236.0 line volts

Lumens per Watt

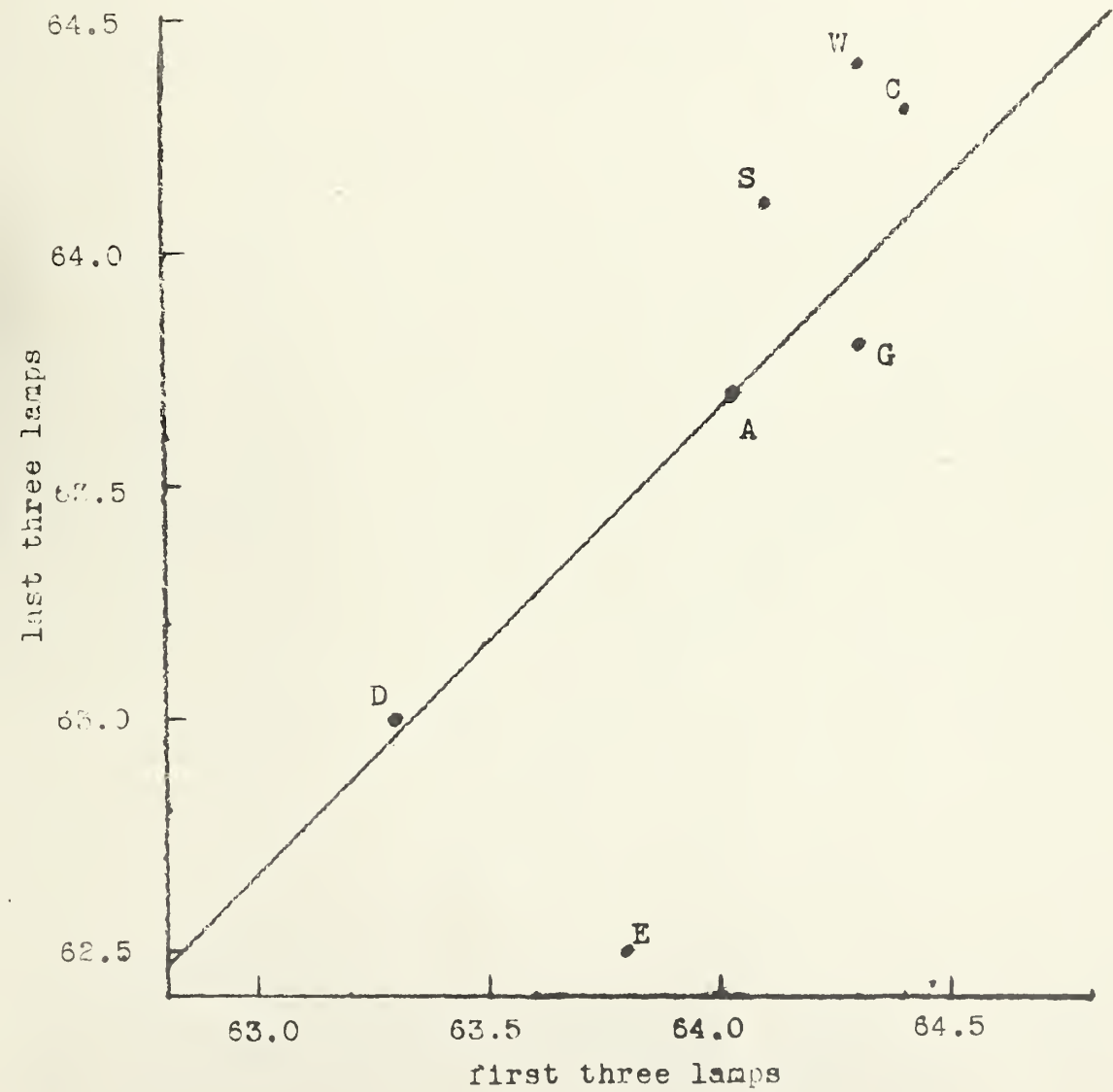




Figure 23

F40T12/Cool White Lamps  
operated at 40 watts

Lumens per Watt

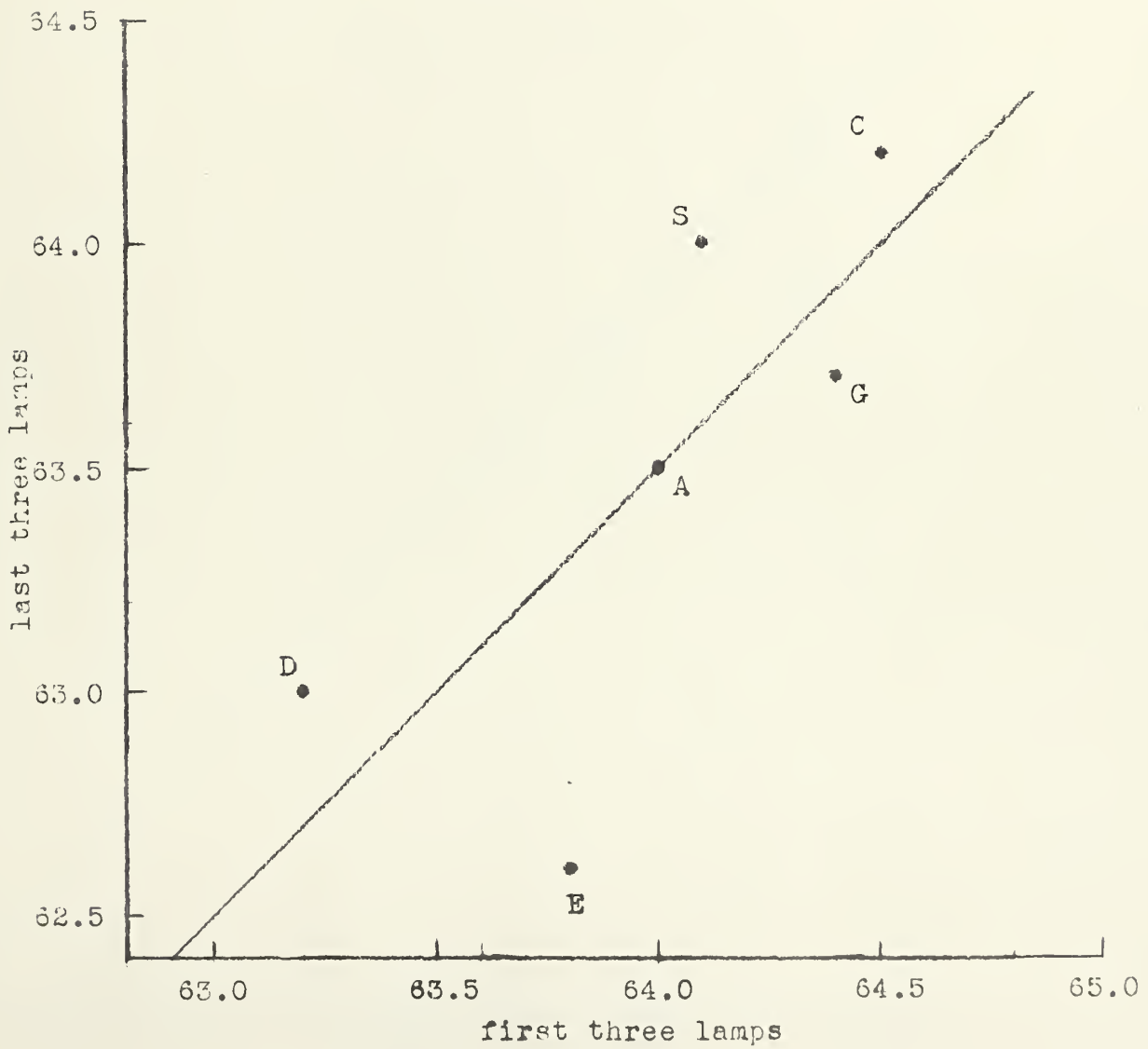






Figure 24

F40T12/Daylight Lamps  
operated at 236.0 line volts

Lumens per Watt

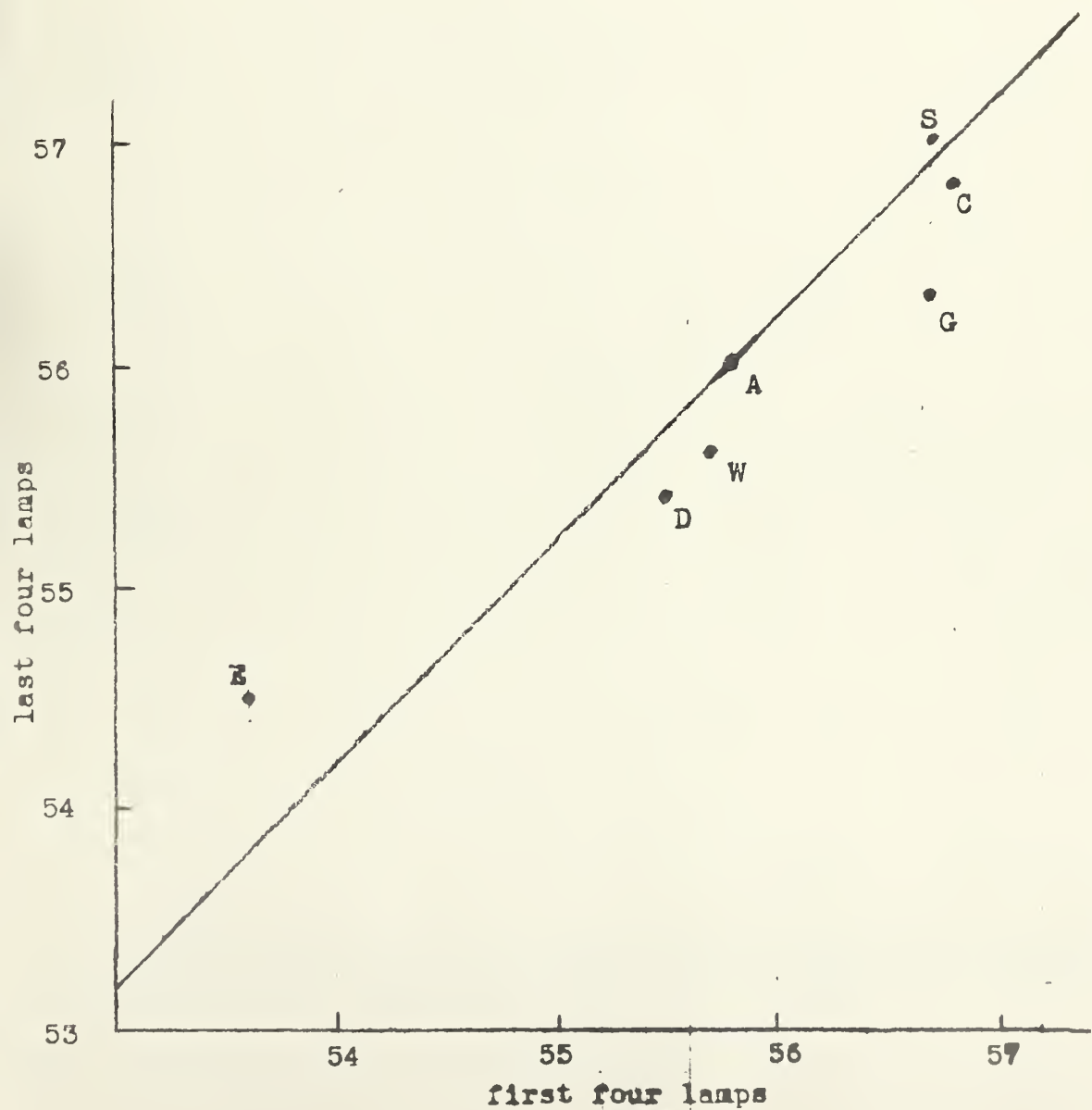




Figure 25  
F40T12/Daylight Lamps  
operated at 40 watts

Lumens per Watt

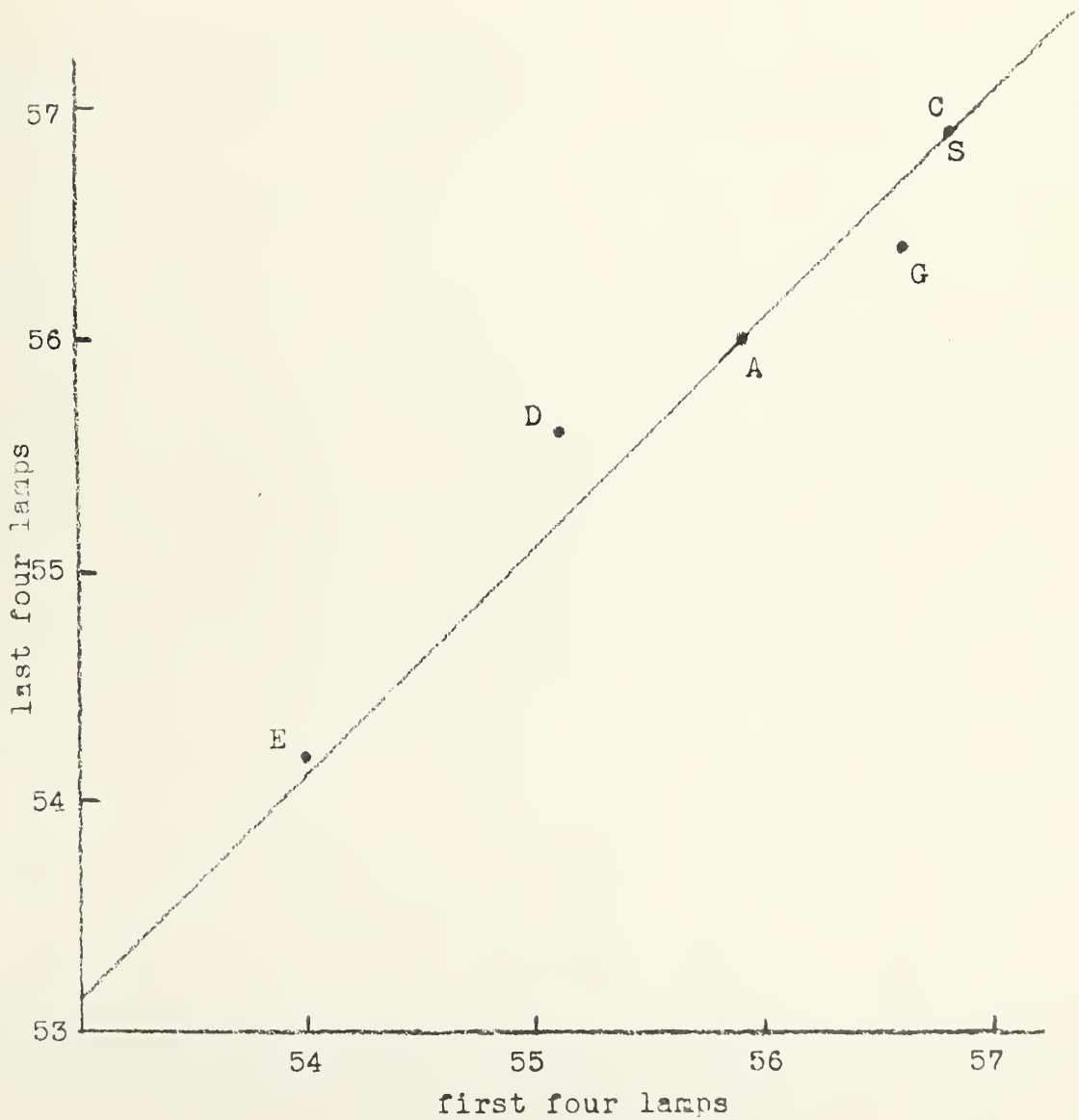




Figure 26

F40T12/Pink Lamps  
operated at 236.0 line volts

Lumens per Watt

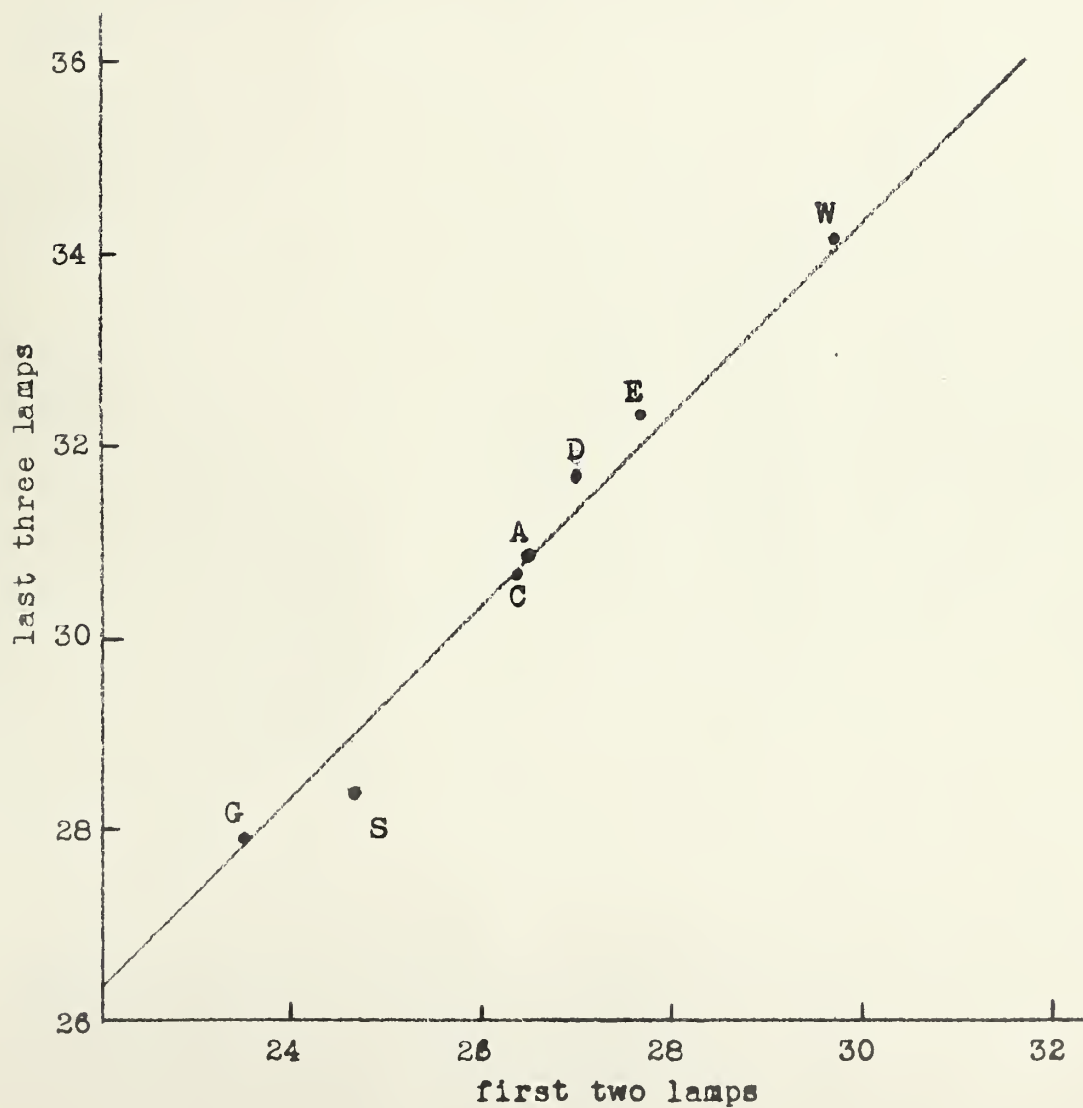




Figure 27

F40T12/Pink Lamps  
operated at 40 watts

Lumens per Watt

